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EDITORIALS

Chemists—and Chemists

ONE conclusion which can be reached from the discussion of the professional status of chemists is that chemistry is a profession whose field can be definitely limited. All brick layers lay bricks. Some lay more or lay them better than others. Practically all physicians deal with the care of the human body, although some are chemists and a few are speculative builders and real estate operators. Many chemists have nothing specific to do with chemicals or materials. Chemists are not only research men and analysts, but also patent lawyers, designing engineers, and plant executives. We no longer say that a man is not a chemist because he has graduated from the laboratory to some form of executive work. If we did, a sizable percentage of our members would have to give up their fellowship in the Institute.

To what does this all lead us? Simply to a realization that the problem is much more complex than the case of the lawyer or physician or other professional group. It will not be so twenty years after there is definite licensing plan for all chemists. Within that time chemistry will have provided boundaries for itself.

Haven't you met someone to whom you were introduced as a chemist, who immediately said, "Oh, yes, I want to ask you a question. Is tincture of ipecac good for colic?"

With all the varieties of chemists in mind can we expect homogeneity or solidarity without some special effort?

Two Synthetic Rubbers

A UNITED PRESS despatch from Mexico reports that Mexico is going into large scale production of tires and rubber heels made of a new synthetic rubber derived from petroleum. If this press notice is correct, it will be simply another of the many cases in history in which discoveries have been made simultaneously by independent workers. In this case there cannot arise any question as to the complete independence of the investigators, since Duprene, the new synthetic rubber developed by the du Pont company is not a petroleum product at all.

Information as to the nature of the new rubber is extremely scarce,

a vivid contrast with the clear, scientific exposition of the discovery of Duprene. Information about the Mexican rubber is so meagre, in fact, as to make one wonder whether there is really anything to it. News agencies are apt to be credulous just now on the subject of synthetic rubbers.

It will be interesting to see whether this new development really does work out commercially. Advance notices are certainly optimistic, with a scheduled production of 300 tires and 500 rubber heels per day, beginning in January.

Isotope of Hydrogen

THE discovery of an isotope of hydrogen, while not altogether unexpected, bears out the theory that other elements are built up from the hydrogen atom as a starting unit. The physics and chemistry of sub-atomic work is daily making further progress toward solving the secrets of matter.

Unfortunately, there is an impassable limit to such investigation, due to the limitations of the physical sciences' greatest assistant, mathematics. With no mathematical formulae applicable to systems involving more than two moving forces, the mathematical analysis of the atom must stop with hydrogen.

When we consider that the elements go up to an atomic number of 92, and that man is completely stalled after studying the simplest one, we realize how little the human race has progressed or ever will progress in finding out all there is to know about the world.

Scientific Sensationalism

A BREATH of refreshingly clear thinking comes from the meeting of the Association for the Advancement of Science. Professor P. W. Bridgman of Harvard takes to task the scientists like Jeans and Eddington, who have been capitalizing scientific sensationalism. For their predictions about the future of the universe and guesses as to its past they have, as Professor Bridgman points out, nothing like sufficient evidence.

Everyone is entitled to an opinion, of course, but when opinions insufficiently backed up by fact become accepted as the principal output of modern scientific thought, science itself is apt to be discredited.

Another subject which has received an entirely undue amount of publicity is the so-called cosmic ray. The existence of waves of shorter wave length than the gamma rays of radium is to be expected simply as a

matter of electro-magnetic consistency. It seems a little far-fetched to assign them, in large headlines, to birth processes of some far distant planet. And when reputable newspaper writers start speculating about the physiological effect of the rays, and bracket them with the "dangerous gamma rays of radium," the thing becomes ridiculous. Obviously, if the cosmic rays are everywhere in the world, all life has become acclimated to them.

Speculations as to whether or not the universe is running down to an ultimate heat-death, or whether or not cosmic rays cause old age, make us a little tired. Science has more valuable things to do, and ought to concentrate on them rather than on sensationalism. Wild-eyed scientific theorizing is interesting, but so is contract bridge—and just about as important.

Synthetic Alcohol

WITH synthetic ethanol now on the market, the question arises as to whether or not the new product can be used as a beverage. Undoubtedly many of the bad effects of drinking have been due to residual traces of fusel oil—and the entire practice has been judged inevitably by its worst examples. We should like to see the result of some controlled experiments comparing the beverage effect of alcohol from ethylene with alcohol from the fermentation process.

Systematic experiments on the entire liquor question would be very interesting. Such experiments have perhaps been carried out, but they play a remarkably small part in the propaganda of either the wets or the drys. The new ethanol might furnish an excuse for instituting research.

Industrial users of synthetic methyl alcohol have certainly had every reason to use it in preference to alcohol from wood distillation on the basis of purity alone, without considering the further quality of cheapness. The same purity may be found characteristic of the new ethyl alcohol. Perhaps in the future the words "synthetic gin" will be a recommendation.

The Chemist—Creator of Wealth

By Franklin H. Bivins

A chemical consultant summarizes the ways in which chemists have added to the total goods of the human race. The economic justification for the profession.

WITH the passage of time there has been a constant increase in the number and in the value of man's worldly goods. With few exceptions each historic cycle finds man the possessor of a greater variety of things. Not only does he have new possessions but he has increased the size or quality and quantity of those already existent. That such a change has always been taking place is indicated by the great divisions of economic history. These are the hunting and fishing age, the pastoral or nomadic age, the agricultural age, the handicraft and commercial age, and the industrial age.

Each of these periods shows an increase in man's possessions due to his initiative and to his inventive ability. His change from the roaming pastoral life to living in permanent dwellings was accompanied by a marked increase in his personal belongings. With all these changes and increases in the worldly goods of the race, we naturally find the individual's average share increasing. With the increase of his possessions comes an advancement in his political condition. His status changes from that of the slave to that of the independent voting citizen. Paralleling both of these changes is his advancement in education.

To most people, wealth implies the ability to purchase without stint. The economist regards wealth as the sum total of an individual's or a group of individuals' economic goods or possessions. To him the lay definition of wealth is merely man's ability to possess economic goods. Money represents man's purchasing power as indicated by the economic

goods he has earned or inherited. Basically money is simply a medium of exchange and has no value in itself. It is not wealth *per se*. To the economist the term "economic good" embraces any and all commodities, manufactured products, natural products, and personal services possessing purchasing or exchange power (that is, value). Any natural or artificial product or service that satisfies a want is a utility. The form of this utility may be elementary, time, place, or possession. From an economic point of view a producer of wealth need not be the primary maker of an economic good; he may be a secondary or contributary factor. The man who applies his knowledge to increase the possessions of the race or to add a utility to an existent economic good is a producer of wealth.

The basic activities of man have to do with the provision of food and shelter. Fishing and agriculture are representative of food production. The extractive industries (mining, forestry, etc.) represent the provision of shelter.

Chemists Assist Agriculture

By his research showing the composition of the soil, the chemist has enabled the farmer to produce more on a given area of land and to keep his land in use longer than was formerly possible. By providing the farmer with means to combat the ravages of insects and fungi, he has further increased the productivity of his land. Development of explosives has given the farmer means with which to clear his land quickly and so increase his productive capacity. Thus the chemist has given the farmer material aid in the production of foodstuffs and so in the creation of wealth. His assistance has also taken the form of providing more markets for this increased production by the discovery of new uses for agricultural products. The manufacture of alcohol from sugar wastes, the development of casein plastics, and the discovery of various corn products and their uses are examples of this work. Research in the preservation of foods has added time utility to many of the farmer's products, and so has increased the available market.

The discovery of quick freezing processes has given added impetus to the growth of the fishing industry and the meat-packing industries. Here again time utility has been added to the products of two of man's important basic activities, thus providing wider markets for them. Here, too, research has discovered uses for by-products and trade wastes from these two industries, thus greatly increasing the wealth of man. In all of these activities the chemist has been instrumental.

AIRPLANE VIEW OF PEORIA PLANT, COMMERCIAL SOLVENTS CORPORATION

By his research leading to greater production and wider distribution of foodstuffs the chemist has tended to set aside the Malthusian Law. This states that there is a definite limit to the world's population, set by the ability of the land to produce food to support it. While this is still true, the chemist has pushed the limit farther and farther away. As this allows more producers to live, it is an indirect contribution to the production of wealth.

The extractive industries owe much to the chemist. New types of alloys with special uses have vastly increased the use of metals. Electrolytic methods have provided better and more economic methods of refining ores. Much wealth has been added to man's possessions by the discovery of the floating process of refining certain types of low crude oils.

Forestry, too, owes the chemist a great debt. His work in this field has been mainly to aid in the conservation of the forest by showing more economic methods of production of goods from this source, also by the utilization of waste. In the past he has pointed the way to the manufacture of products from wood, such as paper, wood alcohol, naval stores. His activity in giving the world preservatives for wood has increased the time utility of the products of this industry.

Recent advances in the building industry are due in the main to the chemist's work. Without his discovery and improvement of cementatious materials, corrosion resistant alloys, weather resistant paints, insulating building materials and the like, we could not enjoy the comfort or size of our modern structures. Not only has he added to the usefulness of buildings, but also to their beauty.

The Chemist in Industry

So much for the basic activities of man. We shall now consider briefly the chemist's relation to the many ramifications of modern industrial activity. Mute evidence of the importance of the chemist's ability to create wealth is that large and important group of stocks which Wall Street calls the "chemicals." When we think of the utilities, the oils, the railroads, the metals, foods, automobiles, amusements, and other groups, we readily see that much of their size and wealth is due to the work of the chemist.

Among the "chemicals," we find such familiar names as E. I. du Pont de Nemours, Union Carbide, Industrial Corporation, Commercial Solvents, Eastman Kodak, American Agricultural Chemical, Allied Chemical and Dye, and many others. These are all well-known industrial giants. To many their products are little known and less understood. Still they represent vast wealth and the production of wealth. The chemist and he alone is responsible for this great branch of industrial activity. Here he has created wealth on a grand scale. What is more important, this basic industrial activity and its products are of primary importance in the creation of wealth in many other lines.

The large chemical research laboratories supported by most of the great industrial groups indicate the importance of the chemist's ability to produce welfare. The size of the laboratories supported by American Telephone & Telegraph Company, General Electric, General Motors, International Nickel, Corn Products Refining Company, Aluminum Company of America, United States Steel Corporation, and others of similar magnitude, attest the important creation of wealth by the chemist.

Recognize Importance of Research

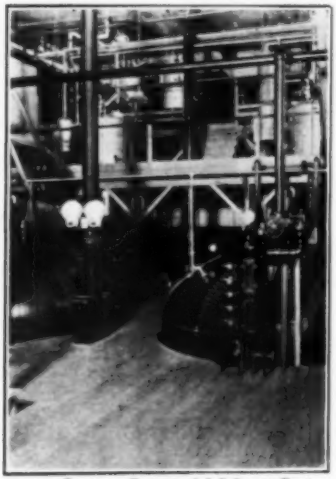
Industry's contributions to chemical research in the universities and the establishment of institutes primarily devoted to research give further evidence of its recognition that the chemist is creative.

The petroleum industry owes its life to the chemist. The refining of crude oil, the cracking of higher fractions, the discovery, manufacture

and use of by-products, the packaging and transportation of its products, and the efficient use are results of chemical research.

The paint and varnish industry owes much of its development to the chemist. Its store of wealth has been increased by his efforts. New pigments, improved vehicles, special drying oils, and the development of dryers are among the contributions. Fundamental research leading to the production of higher quality, longer lasting, quicker drying paints has added much wealth to this industry and the many it serves.

The growth of the rubber industry has been marked to a great degree by chemical research milestones of progress. From the discovery of methods of rubber vulcanization to the many modern uses and forms of rubber, we see continual evidence of the chemist's work.

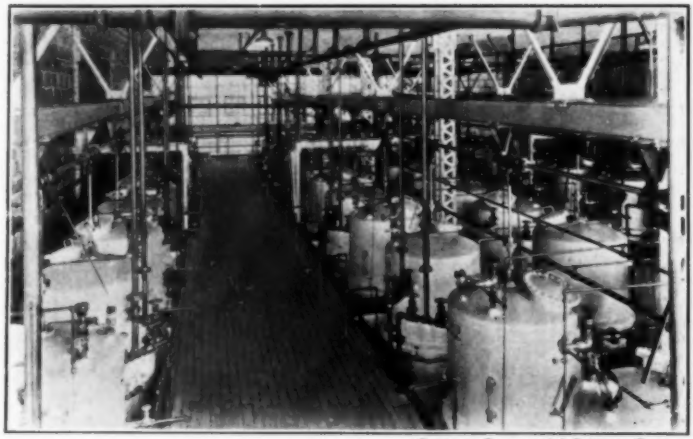


Courtesy Commercial Solvents Corp.
EXPERIMENTAL FERMENTATION PLANT

The modern amusement industry owes its existence to the work of the chemist. The discovery and improvement of films for taking pictures has made the movies possible. Their developing is a purely chemical activity. The chemist is obviously responsible for the accumulated wealth of this industry.

Wherever one turns, evidence is found of the creative work of the chemist. Industry after industry could be described, pointing out places where the chemist has aided by growth and expansion in increasing the value of economic goods. He has enlarged markets, found new uses, improved manufacturing methods, and discovered new products.

The health of the individual is most important to the human race. Without this, his production of economic goods must cease. He then becomes a serious detriment to economic progress, as he consumes but does not produce. In addition, he is taking the time of other people from economic production. The preservation of health and the prevention of sickness is therefore a most important part in the creation of wealth. The chemist is everywhere in evidence in this field. His research has shown what the body is composed of chemically. He has studied metabolism and other natural processes. Comparison of the



Courtesy Commercial Solvents Corp.

BACTERIA PROPAGATION

normal and the sick man have shown what a sick individual may lack. The result of this research has aided the doctor in his cure. It may help him to diagnose cases more ably. The size and importance of the Rockefeller Foundation is graphic testimonial to the chemist's ability in this important work.

From this discussion of economic meaning of wealth and the producing of it and the brief outline of the chemist's part in many major human activities, we can easily see that the chemist is important. Whether in the laboratory, the plant, or the office, he contributes his knowledge to the race.

To exist, an industry or a profession must prove itself an economic necessity. It must show that it can directly or indirectly add to the wealth of the world or increase its store of economic goods. That a belief in the chemist's ability as a creator of wealth can be developed is evidenced by the increasing amounts of money provided him to continue his research. He has been given more industrial laboratories, more endowed laboratories, greater university facilities and, most important, greater freedom to do as he sees fit with the results of his research. The world recognizes a chemist as an integral and important part of its intricate economic structure. It recognizes that he has been essential to the recent rapid advance of civilization and that he is becoming increasingly important.

Eastman Chemical Research

By Walter Clark

The part that chemical research has played in the development of one of the greatest American industries. Varied problems of the chemists at Kodak Park.

THE first observation of the effect of light in producing a permanent or transient visible change in a material must have been made long before the time of Aristotle, whose writings contain the earliest known reference to such an action. The observations were probably first made by those who noticed the tanning effect of the sun on the exposed parts of the body, or the fact that sunlight is essential to the development of the green color in plants. There is, however, no evidence that anybody thought intelligently about it until Aristotle described the effect of sunlight on plant growth.

There is, moreover, little evidence that any attempt was made to put this remarkable action to any practical use for recording purposes until the early years of the eighteenth century, and it was not until a century later than this that the first photograph was made. The discoveries of Niepce, Daguerre, and Fox Talbot in the first half of the nineteenth century roused a great interest in the possibility of using light as a recording medium, and by the middle of the century photography was an established art. A host of workers, chiefly amateurs, engaged in the task of producing pictures by the action of light, and laid the foundations on which the modern photographic industry is based. This industry took its rise in the eighteen eighties.

Each Photographer His Own Manufacturer

In the early days of the art, the photographer himself made the materials he used. He prepared his sensitive mixtures and applied them to glass or paper which he exposed in a camera. He developed them to a negative and then printed them to give a positive image on paper coated with another light-sensitive mixture which he also prepared himself. In time, more and more people became interested, the demand for photographic materials increased, and the preparation of the materials became a commercial proposition. The photographer

ORGANIC CHEMISTRY LABORATORY

was relieved of the responsibility of making his own plates and papers, simplifications and improvements resulted from carefully organized manufacture and the availability of considerable capital, and the number of photographers went up by leaps and bounds. The industry grew rapidly.

A few curious, scientifically-minded photographers in the latter years of last century began inquiries into the properties of the materials they handled, and sought to improve them. They established the basic principles governing the action of light on photographic sensitive materials, and inspired a host of other workers to follow in their path. Like the manufacture of photographic materials, photographic research was begun by amateurs, but now, as is natural, it is carried on mainly by the commercial concerns which have taken over the responsibility for the supply of materials. However, there is still a small body of enthusiastic amateurs who carry out photographic research with great zeal, and who contribute very materially to our knowledge of the photographic process.

The concern of photographic research is the investigation of the principles underlying photographic sensitivity, the preparation of the sensitive materials themselves, and their applications in art, science, and industry. Mr. Olaf Bloch, President of the Royal Photographic Society, has aptly referred to photography as the recording angel of the arts and sciences. There is scarcely a branch of science in which

photography is not used or could not be used, and in modern industrial development its part has been indispensable. It is one of the real concerns of photographic research to meet these needs of science and industry, both by studying the properties of photographic materials in their relation to the problems to be solved, and in developing new materials particularly suited to the new problems that arise.

Emulsion Manufacture Still an Art

The sensitive layer used in photography consists of a suspension of minute crystals of silver bromide in gelatin. This is known as an "emulsion," and for use it is coated on a support of cellulose nitrate or cellulose acetate film, sheet glass, or paper. The technique of emulsion-making developed as an art rather than a science, and in spite of a large amount of physico-chemical research on the problem, the emulsion maker is still of the nature of an artist, guided as much by an accumulation of experience as by the application of scientific principles. The field of emulsion-making still provides apparently limitless scope for research. The useful properties of a photographic film, plate, or paper are bound up, not only with the emulsion, but also very closely with the properties of the support on which it is coated.

Here again is a wide field for investigation. Relatively little is known about the mechanism of the action of light on the emulsion, or about the characteristics necessary to obtain certain desired results. I say "relatively little" guardedly. Obviously an enormous amount is actually known to enable the manufacturer to produce such a remarkably dependable tool as the modern photographic material has shown itself to be. There is still, however, a boundless field for study, involving the application of all branches of physics and chemistry, and, incidentally, of engineering and technology.

An account of the research laboratory of the Eastman Kodak Company will give some idea of the way in which these problems are tackled, and of the part played by the chemist in their unraveling.

Beginnings of Research

In 1886 Mr. George Eastman employed a young chemist to devote his time entirely to experiments. As far as the writer is aware, this is one of the earliest known records of an American manufacturer engaging a trained chemist to devote his whole time to chemical research in industry, at the expense of the business and with no time limit on his efforts. This resulted, in 1889, in a discovery of the greatest importance—the use of camphor in a nitrocellulose solution to produce

RESEARCH LABORATORY

a transparent flexible film on which the emulsion could be coated. The foundation of the modern film industry was laid.

In the earliest days of Kodak Park, a laboratory was established, and this was soon paralleled by other laboratories working specifically for the manufacturing divisions of the company. At the present time each of these departments has a section which can supply it with the scientific information needed for manufacturing operation and control.

The research laboratory proper was established in 1913 under the leadership of its present director, Dr. C. E. K. Mees, who selected the staff and supervised the building and installation of equipment. The original laboratory occupied one building of 19,000 square feet of floor space, and its staff consisted of some 20 persons. By 1922, three additional adjacent buildings had been taken over, making a total of 40,000 square feet, and the staff had grown to 120 persons.

Expansion of Research Facilities Necessary

In recent years, the old laboratory had become so crowded that it was necessary to expand still further. It was decided to build an entirely new research laboratory, making full provision for extension in the future.

After over eighteen months of study and preparation, the new building was completed, and was occupied in the summer of 1931. Nearly

two years were spent on its construction. It has 273 rooms on seven floors and covers 93,000 square feet of floor space. The present staff numbers over 200 chemists, physicists, and photographic technologists, of whom about 100 have university degrees. The design of the building was undertaken by a committee of representatives of all the departments, who worked in conjunction with the engineering department of the company. In this way, it was felt that the particular needs of each department for the present and immediate future would best be met.

The original divisions of the laboratory comprised the departments of photography, physics, inorganic and analytical chemistry, colloid chemistry, and organic chemistry. A department of microscopy and photomicrography was added in 1917, and a technical and service division in 1918. In this year also, the various chemical departments, other than organic chemistry, were consolidated in the department of inorganic and physical chemistry. In 1918, the synthetic organic chemistry department was also formed. This is now an important manufacturing unit of the company, making Eastman synthetic organic chemicals, but it is still affiliated with the research laboratory.

A few other special manufacturing units are responsible to the research director. These include the departments making Wratten plates and light-filters, and X-ray screens. In general, however, the research laboratory exercises no direct control over the manufactures of the company.

Three-fold Purpose of Research

The three functions of research have recently been stated by Dr. Mees to be: to discover new products; to discover ways of making a better product; and to discover more economical ways of making existing products. In accordance with these aims, the work of the laboratory is more or less equally divided into three broad groups, concerned, respectively, with fundamental research, development work, and plant and service problems. An attempt is made to maintain the balance between these divisions, but naturally there is considerable flexibility, and often the last two categories have to be stressed at the expense of the first. Fundamental research that is undertaken must, in general, have some connection with the problems of photography, although no attempt is made to confine it to problems likely to result in immediate discoveries of commercial value.

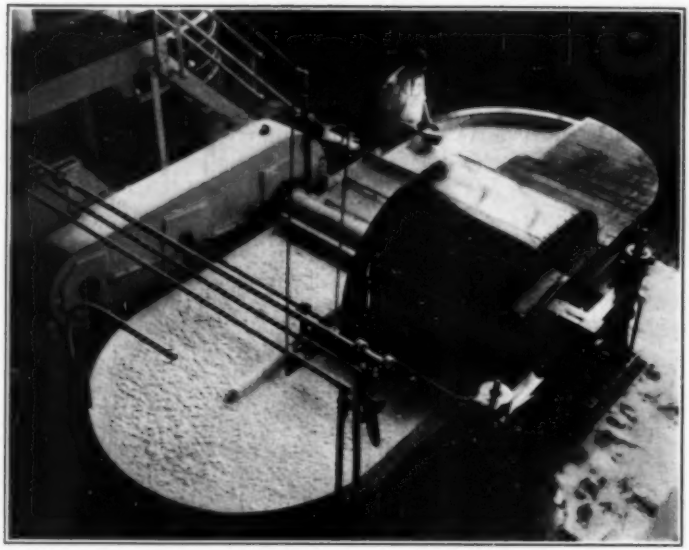
It is the policy of the laboratory to a very large extent to leave the decision as to what research work should be done to the actual research worker, and next to him, the department head. It is assumed that

they are best able to judge the directions in which their work should lie. Moreover, they are untrammelled by the need for preparing estimates of cost in advance of starting new research. It is impossible to determine in advance the rate at which the work will develop.

One of the most important subjects of photographic inquiry is that of the reproduction of tone—that is, the relation between the variation of visual brightness in the subject being photographed and the corresponding variations in intensities in the print. In the early days of the laboratory, this was the problem to which most attention was directed. It can now be said to be satisfactorily solved. It is possible to predict completely and accurately the result which would be attained by photographing any particular subject on any given photographic material under any given conditions of illumination. The working out of this "theory of tone reproduction" did not involve a knowledge of the factors that go to the making of a satisfactory photographic emulsion. It was concerned purely with the film, plate, or paper as a finished product having certain properties which could be measured, and about which certain generalizations could be made. These properties of an emulsion, however, depend entirely on a precise method of manufacture.

PROJECTION ROOM FOR MOTION PICTURES

It has been pointed out that an emulsion consists of a suspension of minute silver bromide crystals in gelatin. When this is coated in a thin layer and dried, it is susceptible to the action of light. Some change is brought about in it. This change is not visible, but it is capable of being rendered so by the use of a chemical reducer known as a developer, which changes the silver bromide to dark metallic silver in the parts exposed to light, but leaves unchanged the silver bromide in the unexposed parts. The unaffected silver halide is dissolved away in sodium thiosulphate solution, and a silver "negative" results. The "sensitivity" of an emulsion concerns the amount of light required to bring about a certain developable change, and this



PULP BEATER

is very susceptible to alterations in the composition and method of manufacture of the emulsion.

The part played by the gelatin is of extreme importance. It might on first consideration appear to be merely that of a medium for holding the silver bromide, and sticking it to a support. These, however, are not its only, nor even its chief functions. Without gelatin, it is impossible to obtain an emulsion of high sensitivity to light, and this sensitivity varies enormously with the particular kind of gelatin used. Gelatin, itself the product of hydrolysis of collagen, contains products of its own hydrolysis in unknown quantities; it contains also inorganic salts in detectable and undetectable quantities. It suffers considerably from its past experiences, and its behavior at any moment is determined largely by the treatment it has undergone in the past. Its properties vary according to the rate at which it is dried, to its water content, and so on. Yet, without it, it is not possible to make highly sensitive films and plates.

The properties of gelatin are, therefore, a large concern of the research laboratory, and much work has been done on its physical and chemical behavior, on the preparation of standard gelatins, and on

its action in sensitizing emulsions. In a study lasting many years, Dr. Sheppard, assisted by the emulsion and gelatin manufacturing departments, investigated step by step the whole process of gelatin manufacture, and succeeding in isolating from the acid deliming liquors a small amount of material which conferred strong sensitizing power on otherwise inactive gelatins. The active material was identified as allyl isothiocyanate; it is present in the original gelatin in amounts varying from 1 part in 300,000 to 1 part in 1,000,000.

In an emulsion, this allyl isothiocyanate is converted to allyl thiocarbamide, which forms complexes with silver bromide; and these, in turn, in an alkaline medium, break down to give silver sulfide. It is supposed that it is this silver sulfide, present in the silver bromide as specks, alone or associated with metallic silver, which is responsible for the extreme sensitiveness of the emulsion. Earlier research in this laboratory and in Europe appears to have established beyond doubt that the silver bromide crystals are not uniformly sensitive, but that there are local points on their surfaces at which light acts preferentially. These are the silver sulfide specks.

Other Factors Also Important

In addition to the nature of the gelatin, the conditions under which the silver bromide particles are precipitated in it are of great importance, and the laboratory has been investigating for years the relation between the precipitation conditions and the form of the silver halide "grains" obtained.

Observation of a film or plate under the microscope shows that the silver bromide is present in the gelatin as discontinuous, crystalline units, and that there is considerable variation in size of the units in one emulsion. Comparison of different types of material shows that in general the less sensitive emulsions, such as process or motion picture positive emulsions, have much smaller grains and of a more uniform size than the emulsions which are more sensitive to light, such as the negative emulsions. In order to study the relation between grain size distribution and emulsion sensitivity, and in order to get for record purposes a convenient picture of the effect of a given set of precipitation conditions on the dispersion of the grains, a photomicrographic department has for many years devoted its whole time to the compilation of size-frequency curves and other statistical data relating to the grains in emulsions. This department works in close cooperation with the laboratory concerned with the study of the physical chemistry of precipitation.

At the same time that research is carried out on the relation between the sensitivity and physical characteristics of emulsions, parallel studies are made of a more fundamental character, in an endeavor to understand the mechanism of the action of light on an emulsion. This is a problem which has engaged the attention of photographic research workers for many years. It has been primarily the concern of the chemist, although it involves many aspects which are the usual province of the physicist. The most recent work shows fairly conclusively that it is the light absorbed by the silver bromide itself, and not by the silver or silver sulphide specks, which is effective. It is thought probable that the presence of these specks causes the light energy absorbed by the grains to be concentrated around the specks and so bring about an increase in their size. When a speck has reached a certain size, it is able to bring about developability of the grain in a suitable reducer.

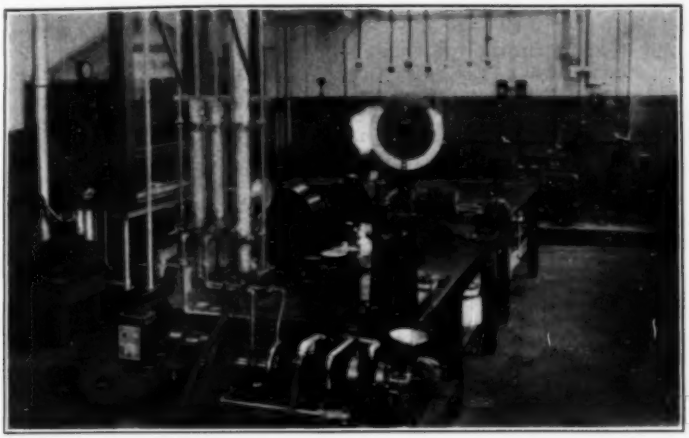
RESEARCH LIBRARY

The study of the mechanism of the action of light on the photographic emulsion led to an exhaustive research on the photochemical properties of silver salts, and, in particular, to a study of the photo-voltaic effect. This research is still in progress, but it has already led to results of considerable theoretical interest. Other observations of value have resulted from a study of the action of chemical solutions which are able to make an emulsion developable without exposure to light.

Investigations of the type described so far are undertaken in the department of inorganic and physical chemistry.

Emphasis on Pure Research

In the organic research laboratory, probably a bigger percentage of pure research is carried on than in any other department. All general problems of organic chemistry are dealt with there, as well as the preparation of organic compounds required for experimental work, ranging from developers to dyes. The particular concern of the de-



INDUSTRIAL CHEMISTRY MACHINE ROOM

partment, however, is the investigation of the properties of cellulose and its derivatives from the point of view of their use in film support, and the study of auxiliary materials, like plasticizers, used in making film. This laboratory is responsible for the preparation of new esters and ethers of cellulose, and its discoveries are applied directly by the manufacturing departments to the making of film support.

The study of the physico-chemical properties of cellulose derivatives, chiefly in the form of "dopes," is the function of a branch of the department of inorganic and physical chemistry. Some years ago, the organic chemistry department made a very complete study of the iso-cyanine and cyanine dyes, and prepared a large number of cyanines and carbocyanines for use in sensitizing photographic emulsions to wave-lengths to which the silver halides are not themselves sensitive. New dyes of the isocyanine and dicyanine types were also made. This work has now been transferred to the synthetic organic chemistry department.

Minute Quantities Analyzed

A highly specialized branch of work carried out in the laboratory is micro-analysis and micrurgy. Many of the defects that occur in the handling of photographic materials are due to minute particles invisible to the eye, and perhaps only a few microns in diameter. A special technique has been worked out in the laboratory for extracting

these particles and analyzing them chemically. A carbon and hydrogen combustion apparatus for micro-analysis has proved very useful, and a hot bar melting-point apparatus has been evolved, in which the material whose melting point is to be determined is spread in a thin layer on a metal bar having a known temperature gradient. The department also possesses a highly sensitive micro-balance.

Close Liaison with Plant Problems

Many problems for investigation arise out of the numberless contacts between the research laboratory and the plant, and there is one section of the laboratory, known as the department of chemical devices, which is concerned with technical problems which crop up in this way. Among the subjects which it has handled successfully are high vacuum technique, devices for automatically controlling and mixing solutions, automatic titration apparatus, the development of light-sensitive elements, and the regeneration of photographic solutions. This last has been introduced into the motion picture industry for the electrolytic recovery of silver from fixing baths and the simultaneous regeneration of the bath. The work on high vacuum technique has led to the development of new condensation pumps which may be used as boosters in all kinds of vacuum apparatus. *N*-di-butyl-phthalate is used in these pumps instead of mercury. Much work has been done on the vapor pressure and vacuum fractionation of phlegmatic liquids, and it has been shown that boiling points at low pressures recorded in the literature are very unreliable.

Control Devices Invented

Another department is concerned mainly with manufacturing control devices, in this case chiefly from the physical point of view. It deals with electrostatics and the prevention of static discharge in machines handling film and paper, with temperature and humidity measurement and control, spectrum analysis for final tests of purity of photographic chemicals, the control of plant operations by means of light-sensitive cells, and so on.

The work of the techno-chemical laboratory is largely of the nature of development work. It deals with general technical and industrial chemical problems, and includes the development of products not directly of photographic interest, but which serve as new outlets for materials produced primarily for the manufacture of photographic products. In this department the process of electrodeposition of rubber from latex suspensions was worked out. Other subjects of investigation

ROLL COATING MACHINES

are the coloring of metals, the preparation of synthetic resins, molding powders, and materials for X-ray-intensifying screens, and the properties of cellulose and its esters.

Service Problems Handled

Another technical laboratory is concerned almost entirely with service problems for the engineering and manufacturing departments. Its activities are necessarily very diverse, and include such problems as the preparation, selection and testing of paints, varnishes, japans and lacquers, lubricants, adhesives, metals and general materials of construction, industrial cleaners, the study of electroplating, and the corrosion of metals.

The department of photographic chemistry is concerned primarily with the problems of practical photography and cinematography. A considerable amount of work is done in the study of photographic solutions—developers, fixing and hardening baths, toning, intensifying and reducing solutions—and it is in this department that the compounding of developing and fixing salts for sale in package form is investigated, and the recommended formulae for processing the com-

pany's films, plates, and papers are worked out. Research is carried out on all phases of the handling of motion picture film, and includes the study of development, fixing, washing, cleaning, and lubrication, as well as tinting and toning, and hypersensitizing. As a result of this work, recommendations are made to the trade for the practical handling of film to insure the best results.

Motion Picture Film Tested

In the film developing section of the photographic chemistry department, routine testing of motion picture film is done for the emulsion coating departments. The tests made concern the absence of defects such as static and abrasion marks, dirt, and so on. As they are additional to the regular exhaustive controls carried out by the manufacturing departments themselves, they insure that the material reaching the market shall be of the highest quality. The amount of material handled in these tests is very considerable. In 1930, 15,000 samples of motion picture film were tested, amounting to a total length of three and one-half million feet.

Among the problems of practical significance studied by this department is the action of photographic solutions on materials used for the construction of photographic processing apparatus, metal, wood, hard rubber, and stone, and recommendations have been made to the trade in this connection. Another problem of the department is the study of the effect of tropical conditions on the keeping properties and method of handling of film and chemicals.

The department of photographic chemistry works in very close cooperation with the service division of the sales side of the company, and in this way handles inquiries received from customers, and makes recommendations on all aspects of practical photography. It is responsible also for the revision of published technical booklets, and the compiling of instruction sheets and formulae.

Fundamental Development Work

A section of the photographic division is concerned with research of a more fundamental character than that described above. It was in this division that the processing of amateur motion picture film was worked out and the Kodachrome and Kodacolor processes of color photography were perfected. Experiments on color photography, the duplication and the reduction of grain of motion picture negatives, and the development of studio equipment occupy a considerable part of the time of this department.

As an illustration of the discovery of new products in the laboratory, the development of the field of amateur cinematography may be taken as a successful example. The object was to find a method by which the man in the street could take motion pictures as simply as he could take still pictures. There were very many problems to be solved before this could be realized. The basic problem was to make sure that a film could be supplied of such a quality and could be processed in such a way that the results would compare favorably with the motion pictures which are seen on the screen in theaters, and which would be taken as the criterion of quality by the public.

The mechanical part of the work, that is, the development of the camera and projector, was relatively simple. For many reasons it was decided that it would be more satisfactory to provide a film which could be processed to give a direct positive picture, rather than a film which should be developed to a negative and printed on to another film to give a positive, as is the case in regular motion picture practice. This involved a very complete study of the production of direct positives by reversal, including the characteristics of the emulsion and the composition of the solutions, the development of a method of insuring uniform quality throughout the positive in spite of variations of exposure, and the designing of apparatus for processing the film exposed by the customer.

COTTON NITRATING

The processing had to be so organized that in the greater part of the civilized world a customer could obtain his film, finished so as to give a good quality picture, within three days of the time it was handed to a dealer. A large number of stations have been established throughout the world, equipped with specially designed apparatus for processing the film. The task of working out a processing procedure which could be used with equal success in the cold of northern Europe or the damp heat of the tropics was satisfactorily accomplished. In 1928 a system of amateur cinematography in colors was perfected.

DARK ROOM IN PROCESS DEPARTMENT

All the work of making photographs for the use of the laboratory in illustrating reports, scientific papers, and lectures is handled in a specially equipped department by a staff of draughtsmen and qualified practical photographers, while developers and other photographic solutions, stock solutions of general chemical reagents, and so on, are prepared in one department for supply to the whole laboratory.

Manufacture of Organic Chemicals

Reference has already been made to the synthetic organic chemistry department. This laboratory was started in 1918 to satisfy the demand for synthetic organic chemicals, most of which came originally from Germany, and of which there was a shortage owing to the war. The work undertaken may be divided into three sections. Of first importance is the synthesis of compounds which are not prepared technically, but which are required for laboratory purposes; secondly, the purification of technical grade materials obtained from chemical manufacturers; and, thirdly, the distribution in small quantities of such technical chemicals in the form in which they are purchased. The chemicals available from this department exceed three thousand in number at the present time, and many more are added each month.

With few exceptions the equipment employed is such as would be found in any organic laboratory. Most of the preparations are carried

out in glass apparatus, on as large a scale as is possible with such apparatus, designed and made in the laboratory to suit the particular purpose at hand. Many new methods of carrying out syntheses have been developed, and particulars of these are gladly given to other chemists who are interested.

During recent years, the synthetic organic chemistry department has been engaged in a study of photographic sensitizing dyes. This has resulted in discoveries of great importance and has made possible the production of emulsions of exceedingly high sensitivity throughout the whole visible spectral range, such as the recent super-sensitive panchromatic film.

Part of Work Done by Physicists

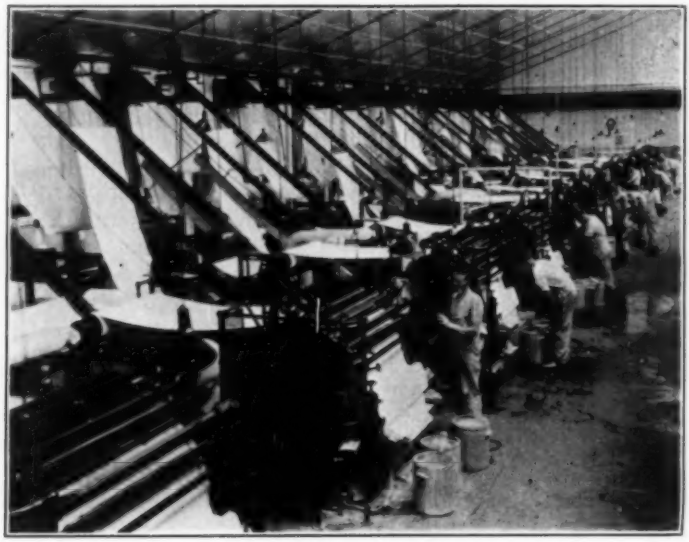
As the concern of this article is the chemist in the research laboratory, prominence is given to his work. The work of the chemist, however, is so closely bound up with that of the physicist, to whom much of our knowledge of the photographic process is due, and who tests and controls to a large extent the preparations made by the chemists, that the article would be incomplete without a brief reference to the physics department.

The work of this department deals with general physics, with especial emphasis on the optical side, radiography, motion picture work, sound recording and sensitometry, or the study of the relation of the photographic image to the light which produces it. Photography is a process of recording by means of light, and it is important for the photographic research worker to know all he can about light—the properties of light sources, the characteristics of light filters and lenses, the reflection and absorption characteristics of materials, the colors of objects, and so forth. It is the function of the physics department to provide this information.

Other Problems

Investigation of the properties of photographic materials may involve a measurement of their response to light under any sort of exposure condition. For a study of these properties the sensitometry department has designed many new instruments, and carries out routine testing of a large number of experimental and special emulsions. It is also investigating the principles of sensitometry with the object of standardizing methods and reducing errors.

Exhaustive studies have been made of the characteristics of emulsions for sound recording, of the resolving power and color sensitivity of films and plates, and of the relation between time and intensity in



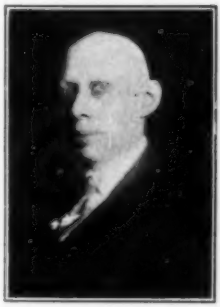
BARYTA-COATING PAPER

photographic exposure. Considerable time is devoted to the study of the problems of the motion picture technician, and to the innumerable problems of applied physics that arise in the laboratory and plant.

This article necessarily gives a very incomplete idea of the scope of the chemist in the Kodak Research Laboratory. It is hoped, nevertheless, that it gives some conception of the wide range of subjects which confront him, and of the satisfactory way in which he has brought some of his investigations to conclusion.

Ethics and Advertising

By Karl M. Herstein



What is to be the attitude of the chemical profession toward advertising? Some suggested general principles to guide professional conduct.

AT THE time of Spinoza, as in that of his predecessors, and indeed until rather recently, it was possible to base an ethical code on divine decree; that is, having established the dogma that man has a moral duty, it was possible by processes of logic to develop this dogma into a complete science. At the present time, it is no longer possible to base a code of ethics in this manner, for the all-sufficient reason that many people no longer consider divine jurisprudence binding.

It is therefore necessary to base ethics for the present day on more practical grounds. This is particularly true of a code of professional ethics. If it is taken as a premise that each member of a profession should act individually as it is desired that the whole profession act for its best increase in dignity, importance, and influence, then it is possible to deduce from this premise a code of precepts of professional conduct. This is especially true in the relation of the chemists to that form of publicity called advertising.

The chemist may come into contact with advertising as does any layman in this time, from the consumer's angle. In this approach, obviously, no special behavior is expected of him as a chemist. It is when the chemist is an active party in the advertising that he must guide his behavior carefully, so as to avoid infringing on those things which constitute his public and professional duty. There are two ways in which he may be the active party in advertising.

The first, and less important of these is the exploitation of his own personality. While this may be done by a chemist, as it is done to a minor extent by a few members of other professions, it is not of particular importance. The public as a whole has learned to discount to their proper value the statements of a man regarding himself, particularly when he is seeking or buying personal publicity.

Necessity for a Code of Ethics

The second and more important connection of the chemist with advertising is when his personality, professional standing, and professional statements are invoked to secure favorable publicity for some commercial product, and it is in this connection that the greatest care must be exercised. It is a matter of common knowledge that large sums of money are available and are used in commercial advertising. Quite naturally, this implies a considerable temptation, so that the establishment of a rigid canon of ethics should be welcomed by the practicing chemist as an aid to him in coming to a decision in the matter of endorsing a commercial article, or as it is ordinarily termed, signing a testimonial.

The patent law of this country has for many years made and found of extreme utility a distinction between what is called a basic invention and a subordinate, or secondary invention. The same distinction can be of the greatest value in the consideration of ethics in relation to advertising. Where a new industrial field is opened, it is certainly of public benefit for the world to be advised in a dignified and sound manner of the function and utility of the new product—nor need the man who has served the public by its discovery be ashamed to stand in the public eye as its sponsor.

It is the feeling of the writer that when it comes to informing the public of a new scientific development in industry, it is quite proper that the product should be identified in the public eye with, and be introduced to the public by, the man whose industry and ability have made possible the new development, even though the space in which the public is so informed is bought and paid for by those who expect to profit from the sale of the article.

Dangers of Competitive Advertising

There is another category of advertising, however, in which much greater discretion must be exercised. This is what is called competitive, rather than informative advertising, in which the merits of one product from among a field are extolled, it being assumed that in the field there

are other products designed for the identical purpose and very possibly with almost indistinguishable differences. Before permitting his name to appear in connection with any product in such a field as this, the chemist must exercise the greatest care that his statements are entirely warranted by the facts, that they neither claim too much nor conceal part of the truth, and that the conclusions are based on premises of accepted validity.

In general, this canon will almost preclude a statement of the superiority of one product over its competitor. By this it is not meant that differences between the products are not legitimate parts of a chemist's statement. The point made is that a decision as to the merits of the products, based on such differences, is very likely to be scientifically unwarranted. To say that a product meets certain specifications and is adapted for certain uses may be entirely legitimate. To say that it is superior to its competitors for these uses is very likely to be unsound.

The general public has had enough experience in recent years with testimonials to appreciate the dignity of a statement in the one form, and to discount the exaggeration of a statement in the other form. Obviously, if the name of a chemist appears in connection with a statement which the public may be disinclined to believe, harm has been done to the profession. An ethical canon of the profession covering conduct in such cases is justified as a protective measure, regardless of whether the conscience of the individual chemist feels strained or not.

Practical Considerations

The general principles covering the form of statements have been outlined above. There remains a matter which is less one of ethics than of business practice. It has been alleged recently that chemists have been misrepresented by statements in advertisements which have not been made by them in the published form. Certainly it is possible for the chemist to protect himself against this form of misrepresentation before rather than after it occurs.

It has been suggested in these pages recently that chemists should guide themselves by what has happened in another profession, where the refusal of American professionals to sign testimonials has caused the use of testimonials by so-called eminent foreigners at considerable financial loss to the Americans. The writer considers that any deviation from the rules outlined above on a basis such as suggested would be most unwarranted from the point of view of professional self-respect and public decency.

Education of the Textile Chemist and Dyer

By Albert H. Grimshaw

What the faculty of a college in the textile region of the South considers essential to the education of the textile chemist.

EACH year in June thousands of young men receive diplomas from our many educational institutions. Among these thousands are quite a few whose diplomas are given for completion of a course in textile chemistry.

This article will consider the training of students in the branch of the industry dealing with fibers and fabrics and with the dyes and chemicals used in their processing. It also will speak of training along other lines, given in the hope that the graduate will be able to fit himself more quickly into the commercial world. This theoretical training plus a few years of practical training under experienced men should enable him to become of value in a shorter time than is possible for the young man who has not had the opportunity of being trained scientifically.

Mr. P. J. Wood gave the following as requirements for a textile chemist:[1]

(1) He must have a knowledge of raw materials encountered in the manufacturing of textiles.

(2) He must be familiar with the quickest and most up-to-date methods of testing and checking the chemicals used.

(3) He should assume control of all chemical processes.

(4) He must be able to initiate and carry out research work.

[1] *The* CHEMIST, May, 1931. "The Chemist in the Textile Industry."

Mr. H. W. Elley[2] of the du Pont Company gives some of the requirements for the making of dyestuffs. As such courses are included in our training, a few words of his paper will be quoted here:

"New chemists are obtained from either the analytical or research divisions of the research laboratory, depending on the nature of the position to be filled. When they arrive, they are familiar in a general way with the handling of large operations but must be trained in the particular processes being operated. Eternal vigilance to detail, the rigid control of purity, the prevention of mechanical loss, the efficiency of labor, the health and safety of the men, the economical treatment of repairs and replacements—all of these must be mastered. Much can be learned from the guidance and training given by the older men. Here, perhaps more than in the research laboratory it is necessary to develop proper human relationships. The plant chemist has to deal with the research man, who develops and hands over to him a process that is supposed to work. He must check it to be certain that he personally can operate it and obtain the desired results. He must maintain the proper contacts with the service departments so that his materials are on hand and his equipment in good operating condition. He must maintain the right spirit in his workmen. He must satisfy his superiors that maximum efficiency and minimum costs are realized. He must keep in touch with the technical and sales departments to make certain that he understands their requirements and delivers the desired amounts of products of high quality. Many times he contacts the customer in order to appreciate his needs or to solve the difficulties with the products he has sold."

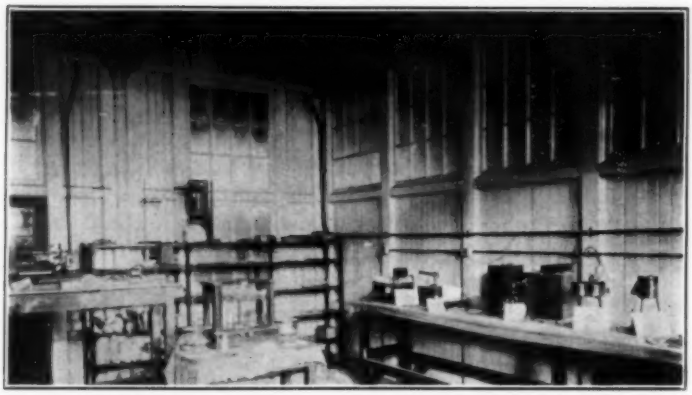
As research is of such importance these days, we will also quote Mr. Elley once more on this subject: "The work of the research divisions is classified under various categories such as (a) control of going processes, (b) improvement of going processes, (c) additions to present lines, (d) new ventures, and (e) fundamental research in pure or applied chemistry."

As regards research, Mr. Wood stated, "The fourth function of the textile chemist—research—may be divided into two parts:

"(1) Fundamental or purely scientific research which may not be directly of commercial value.

"(2) Practical research which is directed toward the end of producing results that may lead to immediate commercial profit."

[2] H. W. Elley, *American Dyestuff Reporter*, June 8, 1931. "Training Chemists in Industry."



PART OF RESEARCH LABORATORY, NORTH CAROLINA STATE COLLEGE

Keeping the above remarks in mind, the reader is requested to note how the curriculum of the school is laid out to cover as many of these points as possible. However, there is no need of impressing upon the reader the fact that the graduate freshly out of school has much to learn and much to forget before he becomes of value in the commercial world. The training in college barely touches many important subjects. It is up to the graduate to go on studying when he accepts a place in the working world.

As the students are going to specialize in the chemistry and dyeing branch of the textile industry, naturally much of their time is spent on subjects or studies relating to these branches. The curriculum is so arranged, however, that other necessary subjects are also studied to some extent. Following is an outline and a few brief remarks in regard to the various courses taken at this school by students majoring in textile chemistry and dyeing. The credits mentioned are each equivalent to one hour lecture work or two hours in the laboratory. It requires two hundred and twenty-two credits to obtain a degree of B.S.

Various other textile schools cover these subjects, with possibly a few hours more on some than on others. Some of the schools emphasize the practical end more than the theoretical end.

Textile Curriculum at North Carolina State

Textile principles. 6 credits. Principles of manufacture involved in the textile industry. As the student is to specialize in the textile field, it is well for him to have some knowledge of yarns and fabrics and the machines on which they are made.

Cotton classing. 6 credits. A study of the cotton plant and factors that determine grade and relative value. It sometimes happens in dyeing cotton that an irregular effect is obtained on the yarn or cloth. This can often be traced to use of different grades of raw cotton.

Textile microscopy. 2 credits. Use of the microscope to identify the different fibers, starches, fabrics; also to help determine cause of faulty dyeing or finishing.

Yarn manufacturing. 4 credits. Lectures and practical work on the making of yarn.

Knitting. 3 credits. A study of yarns used in knitting and their application in making knit goods. The textile chemist is often called upon to analyze or recommend oils used in the knitting processes. This is especially true in regard to knitting rayon.

Fabric structure and analysis. 6 credits. A study of the warp and filling in fabrics, with methods of physical analysis.

Power weaving. 4 credits. A study of the construction and operation of looms.

Fabric testing. 1 credit. Physical tests on tensile strength of yarn and fabric before and after treating.

Dyeing. 12 credits. Study of physical and chemical properties of all the fibers. Study of the action of chemicals and different classes of dyes on all the fibers. Methods of dyeing mixed fibers. Mercerizing methods and study of chemicals used. Testing of dyes for money value and strength.

Principles of fabric finishing. 6 credits. A study of the materials and machinery used in the textile finishing industry, including hosiery and printing.

Textile printing. 6 credits. A study of the dyes and chemicals used in this industry, also of the machinery and methods used.

Color in woven designs. 6 credits. A study of the pigment and light theory of color, and factors which influence style.

Cotton and rayon dyeing. 12 credits. Includes a study of theories of color matching and color mixing. Methods of analyzing materials used in dyeing and finishing such as starch, oils, and sizing compounds. Methods of analyzing water, mold, soap, and materials used on cotton and rayon. Lectures on the making of the different rayons and the effect of various chemicals, dyes, heat, etc., on the rayons.

All of the above are taught in the School of Textiles except cotton classing, which is taught in the School of Agriculture.

In order to round out the subjects as taught in the School of Textiles, which deal primarily with textiles, the other schools also contribute from

their particular field. For instance, the School of Business and Science gives the student training in the following:

Business English. 3 credits. A review of principles applicable to business writing.

Technical writing. 3 credits. The principles of composition applied to the writing of reports and other technical papers.

Public speaking. 3 credits. The fundamentals aimed at are: thought conception, self control before an audience, orderly arrangement of ideas, etc.

Modern languages. 9 credits. Courses in elementary scientific French and German. If the student so elects, he can continue this work as an elective.

Introduction to economics. 3 credits. A study of the great fundamental economic laws which apply to all professions.

Accounting for engineers. 3 credits. A study of statements and cost records.

Industrial management. 6 credits. A study of the textile industry, principles and problems, production and planning methods, administrative control, plant maintenance, etc.

Personnel management. 6 credits. A study of effective management of men. Note how closely these last four courses agree with the remarks made by Mr. Wood and Mr. Elley.

Human relations. 6 credits. An elementary study of the fundamental human institutions, the home, the school, the church, government, and industry.

Introductory sociology. 3 credits. Treats of the basic principles of social life and social organization.

Physics for textile students. 12 credits. A general treatment of industrial physics, with emphasis on practical application to the textile industry.

Mathematical analysis. 9 credits. Showing the application of mathematical principles to practical problems in science and business. These last two courses are especially valuable as a foundation for the textile chemist.

General inorganic chemistry. 12 credits. As taught to all students of the college.

Qualitative and quantitative analysis. 12 credits. All the regular methods as ordinarily taught, and in addition special work on purely textile substances, such as oils, starches, sizing compounds, etc.

Organic chemistry. 12 credits. Regular course, including some work on dyes.

Courtesy Eastman Kodak Company

AN INDUSTRIAL PHOTOMICROGRAPHIC LABORATORY

The following courses are taken in the School of Engineering:

Electric equipment of mills. 6 credits. A study of electric current systems, generators and motors, transformers, mill driving, and operation of machines.

Engineering drawing. 6 credits. Drawing board work, working drawings, tracing, blue prints, etc.

Shop work. 3 credits. Practical use of tools.

Heat engines. 6 credits. Study of fuels and boilers.

Mill and village sanitation. 3 credits. Principles of water supply and sewage disposal; study of public health laws, etc.

The students, if physically fit, are also obliged to take physical training, which helps them to have healthy, strong bodies. They must also take courses in military science, which helps them to obey and also to command.

In addition to all the required courses enumerated, they are also required to take a certain number of credits in elective courses.

With the above training, the student has at least studied the fundamentals of subjects which will aid him later in his life's work if he will apply himself to trying to secure practical experience. But without the will to try to get this experience, he cannot expect to go far, even though he has been fortunate enough to have had the chance to study in his own particular field.

Vivid Technical Reports

By Edward Thomas

A way to remove an obstacle which handicaps many chemists. The value of forceful reports and some hints that will assist in writing them.

WHEN my subject was chosen, I had in mind a picture of more than one business man who has looked at a chemist's report and then looked up at me saying, "What in thunderation does that report try to say?" The business man has then turned to his stenographer and said, "I don't think I can dictate now. I will have Mr. Thomas sit down here and put that report into words that I can understand; then I will ring for you again."

There is almost never any excuse for the man who writes a report which suggests the need of violent language to a business man who reads it. The chemist, or other person, who fails to put a report into words that hold the attention is losing an opportunity. If an employee writes a report in uninteresting words, he is losing an opportunity to fasten a rung into the ladder on which he expects to climb higher; and if a director of other men writes a report in uninteresting words, he is losing an opportunity of centering in himself the confidence of the men and women he directs.

It can be fairly argued that Mussolini was carried up to his pedestal as leader of Italy by his speeches. He said, for example, in one speech, "Some people talk about an eye for an eye and a tooth for a tooth, but where Italy is concerned, I say two eyes for the loss of one eye, and a whole mouthful of teeth for the loss of a tooth."

I think I can put into your minds a simple rule, based on the rule that Mussolini uses—a rule for so selecting words in reports that the

reports will be inevitably interesting. I may summarize that rule now—it is to cut out all abstract words. You will note that Mussolini uses no abstract words when he says, "Some people talk about an eye for an eye and a tooth for a tooth."

That rule was followed by many other leaders long before Mussolini. It was followed by Napoleon Bonaparte. Napoleon did not hold out before the eyes of his men vague, high-sounding words like "promotion." He said to his men: "Every one of my soldiers carries a marshal's baton in his knapsack." In Egypt he did not say, "You are on historic ground," but he said, "Forty centuries look down upon you." He, in a way, personified history—dramatized it.

Can Dramatize Technical Writing

A stenographer proved to me, some fifteen years ago, that it is possible to dramatize highly technical descriptions in the same way. I was studying a very complicated patent application covering a typewriter-adding machine and had propped up the six or eight sheets of drawings around my desk to follow on them the working of the parts while the stenographer read me the specification describing how the parts worked. That description had been written by one of the best specification writers in the United States. In the middle of her reading the stenographer paused a moment and then exclaimed, "Why, this sounds interesting." Some weeks later another stenographer, reading another complicated description by the writer, made the same exclamation. These girl stenographers could not possibly have understood the working of the machines from the sentences they were reading, but something peculiar in the words which were put into the sentences made the descriptions sound interesting.

It was ten years before I found the peculiar something put into those words, but I believe I can explain that peculiar something in less than ten minutes.

The first hint came from the essay called "Laokoön," written by Lessing a hundred and fifty years ago. Lessing says that Homer does not describe, one after another, the clothes that Achilles wore; Homer tells how Achilles put on his clothes. In other words, Homer makes a description of clothes interesting by making the details in them incidental to the drama of seeing Achilles put them on.

Even if we cannot hope to reach the level of renown that Homer reached, we can profit by his example in describing our tests and experiments. The ingredients used, and the apparatus in which

they are, so to speak, clothed may be described as incidents to the mixing, the heating, the cooling, or the travel of the ingredients. Or the apparatus and the ingredients, especially in reporting a continuous flow process, may be described as if an ingredient were a spectator seeing the parts of the apparatus while being carried along through the apparatus.

Let me illustrate how it is possible to describe a mechanism as an incident to the way it works, choosing as an example a patent application of a client who wants to sell his invention.

"This invention relates to fluid-controlling valves and is herein illustrated as embodied in a valve especially adapted to be operated by a weak source of power for controlling the flow of air, although the same valve is also useful for controlling liquids. The form of the valve herein illustrated is especially designed to enable distant devices to be operated by air or other fluid pressure coming through the valve, the valve being so easily operated that it offers no appreciable resistance to the highly sensitive power of an ordinary thermostat.

"In the form herein illustrated the rotating member of the valve consists of a plug adapted to be rotated in a seat so that certain delivery passages or certain discharge passages in the plug selectively register with passages in the seat or the body of the valve, with the result that a pipe beyond the body of the valve becomes either a delivery pipe or a discharge pipe, according to the rotated position of the plug. In the form illustrated the fluid enters the valve through a central bore in the plug and the bore leads to the delivery passages, thus making it possible to completely balance the fluid pressure around the sides of the plug by cutting the passages symmetrically on the periphery of the plug.

"In one position of the valve in the form shown, fluid coming from a pipe 10 enters the central bore 11 of a plug 12, and passes through it to a chamber 13 at the far end of the plug. From the chamber 13 the fluid flows through small longitudinal delivery passages 14, which lie in the plug outside the bore 11, back toward the middle of the length of the plug passing there from the passages 14 into delivery longitudinal slots 15. From these slots 15 the fluid is shown as passing into corresponding slots 16 lying in the seat 17 of the valve and registering with the slots 15, and thence the fluid passes into an annular opening 18 in a hood or casing 19 in which the seat is mounted."

Sentences describing a chemical experiment to produce a new product are much more easily put together so as to describe the materials as

an incident to the picture of the mixing, heating, cooling, or travel of the materials. For example, let us take a few lines from my own patent No. 1,825,834.

"One-quarter ounce of the second-hand paper pulp used for making roofing materials was agitated in about twelve ounces of water, as for the froth-flotation ore concentration process, in a Hamilton-Beach bar-mixer. To this was added five and one-half grains of ammonia alum dissolved in about an ounce of water, and agitation was continued. Then, during agitation, there was added drop by drop sixty drops of a solution of one part of asphalt in two parts of motor benzol. The fibers of the pulp took up the asphalt and were apparently uniformly colored by it. They floated clear of the bottom before removal from the jar."

The parable of the Prodigal Son, said to be the best page of descriptive writing in English, uses neither the word love, nor the word forgive, although it is a lesson in love and forgiveness. Hardly any abstract words are used in the English version of the parable and none in the original Greek. For example, the word translated "had compassion" might be translated "his heart came up in his mouth." The story is one of action, in which the servants are told to, "Bring forth the best robe and put it on him; and put a ring on his hand and shoes on his feet, and bring hither the fatted calf and kill it." The sentences of that parable may well serve as models for the sentences in scientific reports.

Bad Writing Kept Mendel in Obscurity

Because Mendel, discoverer of the law of inheritance, was an uninteresting writer, his experiments were buried for thirty-five years, and both he and the experiments were almost lost to the world. Eighteen years after his death another scientist discovered an account of Mendel's forgotten experiments buried in an almost unknown local journal, rewrote the account, and persuaded the inattentive world that the experiments were important and that Mendel was a great man.

Charles Darwin wrote his *Origin of Species* in words that hold the attention. Perhaps he was feared and hated by the religious leaders of his day because his words were more interesting and more persuasive than the words of those leaders.

People who read Galileo's books in the original tongue say that his epoch-making experiments are so clearly and simply described that a

child can reproduce them. And the letters of Benjamin Franklin to a girl of twenty have recently been published as a clear account of the scientific progress of his day.

One child ten years of age, who lived in the same apartment house with Professor Albert Einstein, is said to have discovered that she could always understand what the great scientist explained to her. One day the child asked her mother some question and, not comprehending the meaning of the reply, is said to have remarked, "If that is the best explanation you can give, I am going upstairs and ask Professor Einstein to explain it to me. I can always understand what he says when he talks to me."

Science is an art which seems to begin with the analysis of sense-experiences, but prior to the analysis of the sense-experiences comes the selection of the sense-experiences which are deemed to be worth analyzing. The effective scientist is one who clings close to sense experiences, and describes them clearly—clearly to himself, as well as to others.

Professor Jeans, in his book *The Universe around Us*, has explained some of the difficulties facing a scientist. He refers to the electron and the proton as phenomena in the branch of physics called "wave-mechanics," and then continues:

"It is easy to explain the motion of the earth round the sun in the solar system. We see the sun in the sky; we feel the earth under our feet, and the concept of motion is familiar to us from everyday experience. How different when we try to explain the analogous motion of the electron round the proton in the hydrogen atom. Neither you nor I have any direct experience of either electrons or protons, and no one so far has any inkling of what they are really like. So, we agree to make a sort of model in which the electron and proton are represented by the simplest things known to us, tiny hard spheres. The model works well for a time and then suddenly breaks in our hands. In the new light of the wave-mechanics, the hard sphere is seen to be hopelessly inadequate to represent the electron. A hard sphere always has a definite position in space; the electron apparently has not. A hard sphere takes up a very definite amount of room; an electron—well, it is probably as meaningless to discuss how much room an electron takes up as it is to discuss how much room a fear, an anxiety, or an uncertainty takes up."

Professor Jeans gives us a clew to a more satisfactory rule for making reports interesting than merely to omit abstract words. He uses the term "everyday experience." Most people seem to remember

their everyday experiences as visual pictures, hence we may restate the rule as, "To be interesting, use only words which paint clear, vivid outlines of visual pictures—use only sense-experience or sense-impression words."

Most sense-experience words are short, like "hand," "head," "hold," "walk," "fall," "lift," "drop." Many of these sense-experience words are four-letter words. Perhaps this explains why a statistical investigator of the words used by Shakespeare and other writers found that Shakespeare is the only English writer who used more words containing four letters than words of any other length.

One example of the use of four-letter words is the familiar quotation, "Lend me your ears. I come to bury Caesar, not to praise him. The evil that men do lives after them, the good is oft interred with their bones." Of these twenty-nine words, ten are just four letters long. The same investigator found only one English author who used more two-letter words than words which were longer or shorter. That writer was John Stuart Mill. His sentences were so involved that he had to use many prepositions to clarify his meaning.

Words to Be Stressed

In naming sense-experience words as the words to be put into sentences, it should be remembered that nouns, verbs, adjectives, and adverbs are the only words which are the names of sense-experiences, as contrasted with words naming abstract ideas. Other words like conjunctions, prepositions, and pronouns may be temporarily ignored in writing. Some people may find it easiest to write out hastily a first draft of what they want to say in full, and then revise at leisure, marking every noun, verb, adjective, and adverb which does not contribute to making vivid the outlines of a visual picture. This is really editing the first draft.

I think I can give you the clearest picture of what this editing does by telling an experience of Mrs. Thomas. She had told a series of stories to some twenty thousand children, and I had urged that she should not drop them and ultimately let the stories die with her. She wrote out the stories and sent the manuscript to a publisher. It came back with nothing more than a printed rejection slip. She sent it out again and again and each time it came back with the same kind of rejection slip. She became discouraged and threatened to throw the manuscript away, but asked me if I had any suggestion.

My reply was to quote a sentence I had once read in a book on feature-

article writing, saying that, "The way to make an article interesting is to write it in sense-impression words."

She went through her manuscript, carefully marking every "beautiful," every "pretty," every "ugly," and the other abstract words. Then she replaced these abstract words with "sense-impression" words. The example she gives of this work is how she changed the remark of the boy-hero when he saw the great lilies of India, *Victoria Regina*. Originally she had made him say, "See those enormous lily leaves." She changed it to read, "See those lily leaves. Every one is as big as our dining-room table."

She retyped the manuscript and sent it to Revell, one of the well-known publishers. In a few days she received a letter asking her to call at their office. When she arrived, the president of the company came out to greet her, saying, "Mrs. Thomas, you have written a book which the world needs, but in a way it is too good for us to publish. It requires a certain type of fanciful illustration which we never use. But you must get it published. If the next publisher refuses it when you send it to him, it will only be because he has on his presses a book which your book would kill."

Within thirty days the publisher Nelson accepted the manuscript, saying no book had ever been recommended by any reader as highly as the reader had recommended this.

The most important part of my story of that book is yet to come. When my wife marked the abstract words, the marks made no conspicuous show on a page. She thinks there may have been six or seven words per page that she changed, that is about two per cent. I estimate the change at one per cent, that is, three or four words changed to the page. The point of my story is that she converted a manuscript that was a failure into a success by cutting out the last one or two per cent of abstract words.

Method of Revision

One rule has, therefore, become "Cut out every noun, verb, adjective, and adverb, which does not contribute to a visual sense-impression. Replace with the words which make the clearest, accurate visual images. If necessary change the grammatical structure to accomplish this end.

"Even one abstract word to a page will break the hold of the writing on the mind of the reader."

Here let me put in a few words to draw a psychological lesson. No one abstract word seems to make any difference when looked at alone,

on a page. I believe the psychological lesson is that sense-impression words keep up a continuous beating or knocking at the door of the brain. The knocking is not very loud, and it will be effective only if it is never interrupted for a moment. The introduction of an abstract noun or verb or adjective or adverb interrupts the knocking, and makes the brain of the reader or hearer momentarily turn to another kind of work, destroying the continuity of the knocking and relaxing the hold of the words on the senses or on the brain. Once the hold is relaxed, it is regained only after a new struggle.

Use Present or Past Tense

To cause a verb to draw or paint vivid outlines of a visual picture the present or past tense of the verb should be used in the sentence. The future and the subjunctive should be avoided. In describing a product, reports often say, for example, "The precipitate is yellow. It will dissolve in the cold in acetone and could be sublimed at a low temperature."

To be vivid and interesting the report should describe visual facts as facts, not as future possibilities. Thus, the report would become interesting by saying, "The yellow precipitate dissolved readily in cold acetone and sublimed at a low temperature."

For the same reason an attempt should be made to find some way of avoiding every word which is needed only to complete the grammatical sense, like the verb "is" quoted above, in the sentence, "The precipitate is yellow." Chinese grammarians give the name "empty" words to such words. In the revised words this sentence was merged with the one that followed it, omitting the empty verb "is."

I think I can prove from the vocabulary of chemists that more lies back of that choice of words than is implied in the word empty—that the mind of man unconsciously separates fact from a mere possibility. A number of years ago we often heard the term "eka-manganese," but when the element eka-manganese was identified as actually in existence—a reality, and not a merely possbile element—then the term "masurium" was adopted as a name. So I am only suggesting that a writer use words which fit easily into the unconscious workings of the mind of man, clinging to words which create real pictures of experience.

Chemists in writing reports often word their sentences obscurely, as, for example, "When *ab* and *cd* are brought together in solution a reaction takes place. The reaction apparently seems to follow along

the lines represented by the equation

$xab + ycd = mac + nbd + z\ abcd$."

Such a report would be briefer and clearer if it were worded "*ab* and *cd* react in solution, apparently as follows:

$xab + ycd = mac + nbd + z\ abcd$."

I have turned the abstract term "reaction" into a verb of action, thus giving a touch of drama to a chemical report.

When we thus turn sentences around, converting abstract nouns into verbs, and in other ways replacing abstract nouns, verbs, adjectives, and adverbs—replacing them with picture-bearing or sense-impression words and phrases—we are practicing a psychological engineering of words in sentences. I would call this engineering by the name of "editing," but it requires much more serious revising than does most editing. It is editing as Shakespeare edited the writings from which he took the bodies of the plays which have made him famous.

Some writers, like Joseph Conrad, are very skillful in selecting verbs which add vivid outlines to a picture. One of the most persuasive of modern preachers said in a radio talk, "An abstract word is a well without water, a house without a family to make it a home, a body without a soul." But positive definition of a word will help us more than those negative pictures.

Most people do their thinking mainly with the aid of visual images, so we must not think of words as tools of thought, but as tools for putting images into the minds of others.

Words are tools, the strangest tools ever put to work by the hand or the mind of man.

The persuasive writer, the persuasive chemist must learn to look on words as tools with which he undertakes to build a machine for putting ideas into the minds of other people.

Some Chemical Aspects of Bacteriology

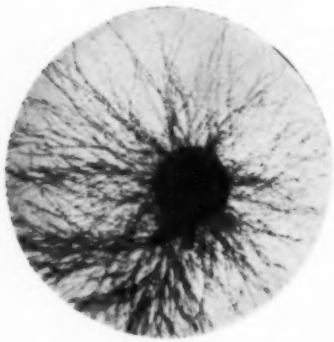
By M. Starr Nichols

A biological investigator tells about the importance of chemistry in identifying and in fighting pathogenic bacteria.

THE aphorism, that chemistry is the basis for all life processes, is nowhere more strongly supported than in the realm of bacteriology. The chasm between colloid and biological chemistry has become so constricted by recent findings in virus bacteriology that only a narrow gap remains. Among these ultramicroscopic forms of life we approach dimensions comparable to those recorded in the literature on studies of colloidal aggregates of metals. Thus the value of 30 millimicrons is given by Duggar and Karrer (1921) for the approximate diameter of the virus particle of tobacco mosaic. On the basis of filtration experiments through acetic-collodion membranes of known permeability to water and colloids, Clifton, Schultz, and Gebhardt (1931), state that the virus of poliomyelitis has a magnitude of between 50 and 110 millimicrons and possibly below the first value. These diameters compare quite favorably with those obtained from measurements of certain inorganic colloids such as those of gold, which may range in size from 10 millimicrons up to 100 or greater. However, if the size of virus particles is compared with du Noüy's result for a molecule of egg albumen (*i. e.*, 4.1 millimicrons) the virus particle is seen to have approximately ten times that diameter and really quite an enormous volume (vol. of sphere = $^4/_3\ \pi r^3$) by comparison.

Even though these filterable viruses approach in size the colloid particle, they retain in the passive stage their dynamic equilibrium for

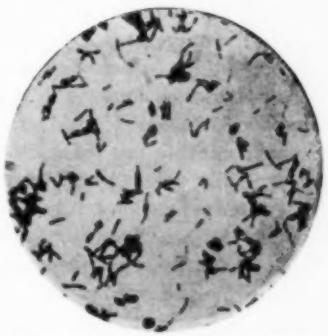
long periods of time and again are able to exert an influence characteristic of their former environment if conducive conditions obtain. Under ordinary conditions some viruses retain their activity *in vitro* for as long a period as five years. Others become inactive within a few days. Reproductive capacity under favorable conditions, however, separates them distinctively from the large group of colloid catalysts. While cultivation of viruses *in vitro* in the absence of living cells has not been definitely proved, evidence is at hand that they can be propagated *in vitro* in growing tissue cultures. The growth of most of the viruses *in vivo* or *in vitro* is conditioned by the selection of the suitable living host in the former case and suitable cell cultures from the proper host in the latter case. Thus the cultivation of the virus which causes the development of Negri bodies in rabies is apparently dependent upon its propagation in the nerve tissue of live susceptible animals, while the virus of Rous' sarcoma has been found to prefer live cultures of macrophages to rapidly proliferating fibroblasts.



PATHOGENIC FUNGUS COLONY

Within recent years virus diseases have taken on an added significance from a scientific standpoint due to rather authoritative work reported from several sources on the filterable stage in the life cycle of many of the common pathogenic bacteria. Reasoning from analogy it has been conjectured repeatedly that our virus diseases are caused by the filterable stage of a microscopically visible etiologic organism which resists cultivation in ordinary bacteriologic media. Kendall's (1931) recent announcement of a suitable medium for the growth of the filterable stage of many of the microscopic pathogens already known, as well as the detection of viruses from pathological conditions in which no microscopic form of life has been seen, seems a step in the right direction. Ho finds that a colloidal suspension of native proteins deprived of their alcohol and fat soluble constituents, sterilized by autoclave temperatures, serves his purpose very well. It would be interesting to speculate why the filterable stage of bacteria require colloidal food material while the normal stage (those visible by the aid of the microscope), are content to live upon the small molecules. Bacteriophage, a viable virus, is apparently still more fastidious in its likes and dislikes. It requires young

viable bacterial cells for its propagation and will not utilize these cells after they die. It is upon the likes and dislikes of bacteria that we depend for identification of types. Some require atmospheric oxygen, some refuse to grow if it is present, while others are not particular. Almost all organisms are able to utilize dextrose, but the same cannot be said for lactose and many more of the rarer carbohydrates such as xylose and rhamnose. Indeed, the principal basis for the classification of bacteria is the type of action which they evince toward carbohydrates and the related polyhydric alcohols. Thus in bacteriology, since the time of Pasteur and his discovery of the avidity of penicillium for dextro-tartaric acid and an equal disdain for the laevo form, chemistry has been applied with such success that it is fast becoming an indispensable tool in the bacteriologist's work shop. Not only is observation made of the ability of organisms to utilize a wide variety of substances of known purity but cognizance is taken of the end-product of their action. Thus, *b. aerogenes* is partially identified by its ability to produce acetyl methyl carbinol from glucose. To prove that there is present this by-product, it is oxidized chemically to di-acetyl, which substance immediately combines with the peptone present in the medium to produce a pink coloration which has been found specific for this particular by-product. Isolation of end-products of bacterial action is accomplished where the quantitative measurement of action helps in the identification. While morphological studies of the form, size, manner of reproduction, and staining characteristics of bacteria are valuable criteria of the variety under observation, chemical identification of products of growth usually forms the most important link in the chain of proof of type.



CORYNEBACTERIUM DIPHTHERIAE

Bacteria through their action on food material at hand are constantly producing profound chemical changes in all forms of matter which they attack. The odor of hydrogen sulfide in well water is probably caused by the reducing action of certain organisms on sulfates normally present in the water. Bacteria are responsible for soil fertility, for it is through their action that dead organic matter is mineralized to plant food. The cycles of nitrogen, carbon, sulfur, and phosphorus in the process of decay and preparation for plant use are catalyzed throughout their

entire course by the microscopic forms of life and their attendant enzymes. Not only do bacteria re-work biochemically the waste products of death into plant food for re-distribution to man in the form of usable food, but certain forms in the nodules on the roots of legumes continually operate the greatest chemical factories known to man in the fixation of atmospheric nitrogen.

Bacteria in Chemical Industry

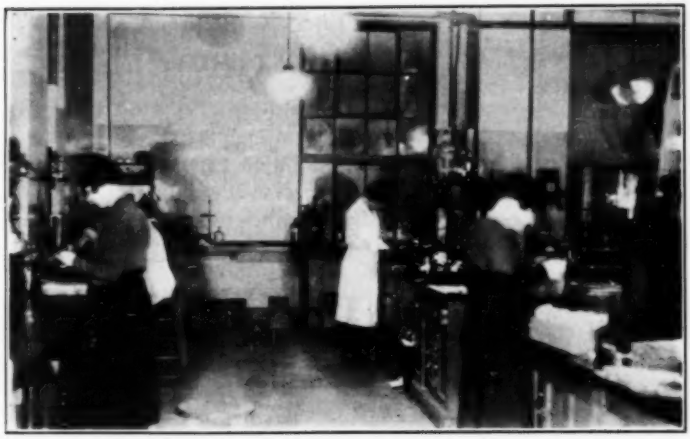
Because of the constancy of action of these minute forms of life, they have become the servants of man. The making of a fine quality of cheese is possible because only a pure culture of the proper organism is allowed to act. In Swiss cheese a propionic acid producing organism which has carbon dioxide as one of its end-products is used to form the eyes. In Limburger cheese proteolytic types are necessary, while in Roquefort a bluish green mold is the inoculation.

In industry also we have a good example of bacterial service. Butyl alcohol and acetone, which find extensive use in the motion picture industry as film solvents, are the result of the action of an organism which was first isolated from lake mud. This organism is now engaged in the conversion of corn mash to these useful solvents. The ubiquitous yeast has caused the government of the United States more happiness and sorrow than the winning and losing of many battles. Its carbon dioxide causes bread to rise, refrigerates our perishable products, and adds flavor to our fountain drinks. Its vitamine and health-giving qualities are probably overemphasized, but its principal product, ethanol, is the topic of conversation of all. The Eighteenth Amendment would have few violators if the activity of this tiny cell were under government control. Not only in the manufacturing realm do bacteria find an important rôle to play, but much to our sorrow, many are enemies to mankind.

Pathogenic Bacteria

While by far the greater number of bacteria are beneficial to man's well-being, there are a limited number which attack his body and produce suffering and death. These pathogenic types are known to most of us by name, but it is only a very few whose actions we have been able to control. The production of antiseptics, specific therapeutic chemicals, and active principle isolations from organic drugs have all been contributions by chemistry to the battle against these invaders.

There are many chemical problems awaiting solution. Masses of data in bacteriology are annually accumulating; but there is an acute



WISCONSIN STATE BACTERIOLOGICAL LABORATORY

need for less empiricism and more basic data concerning the chemical metabolism of these microscopic and ultra-microscopic forms of life. The bacteriologist's laboratory is fast becoming a chemist's workshop, with reagents and retorts taking the place of many of the empirical infusions formerly used. Conditions of culture are chemically controlled with food material composts prepared from pure reproducible chemical entities.

Bacteriology is still a very young science as compared with chemistry. Progress seems to be conditioned by the ease and with the rapidity with which chemistry is made to function to its fullest extent in the science. Life processes even of these minute forms of life are complex but still discernible if proper chemical attack is made. The chasm between animate and inanimate forms of matter is waiting for the artisans and the philosophers to begin a bridge. The task will be largely chemical. On the one side of the gap we must find the organic and biological chemist with his complex syntheses and analyses, on the other the colloid chemist with his correlations and interpretations.

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E. V. McCollum, Nutrition Expert

By S. M. Weisberg

The story of a chemist who has helped the human race by teaching it what it should eat. A biochemist who still has much of his most valuable work ahead of him.

"DEAR SIR: This is in response to your request that I write a short article on 'Why I Chose Chemistry as My Profession.'

"In my boyhood days and through high school I hoped to enter the medical profession; and I selected my undergraduate studies in the University of Kansas so as to include as much pre-medical work as possible. Realizing that chemistry would be a strong ally of medicine, I did much optional work in addition to the required courses in the chemistry department; and I became sufficiently enthusiastic about chemistry to abandon the idea of studying medicine and become a chemist. I had no plans further than to specialize in organic chemistry. For this purpose I went to Yale in 1904, and during the next two years prepared a thesis under the direction of Dr. Treat B. Johnson.

"When I reached the point of getting the Ph.D. degree, I met with great difficulties in securing a position which was at all attractive; and so I remained an additional year at Yale, studying physiological chemistry and experimental physiology. In 1907 I had three positions offered to me, all of the same kind and all in agricultural experiment stations. These were at the Universities of Wisconsin, Illinois, and Missouri. On Doctor Mendel's recommendation I selected Wisconsin. Their desire for a physiological chemist was based upon the fact that they were engaged in nutrition problems which demanded the services of such a specialist.

"The nature of my duties at the Agricultural College at Wisconsin determined the line of work which I have developed, namely, research in nutrition. If I had got an attractive offer in 1906 to teach organic chemistry, with some prospect of time for cooking up a little research, I should doubtless now be numbered among the organic chemists of the country, although possibly pretty well down in the list."

* * * * *

THE above letter constitutes a simple little essay which is typical of E. V. McCollum—matter of fact, free from all pretense, and modest. We get a fleeting glimpse from it of the man's early academic career. But this period was by no means such clear sailing as the letter might indicate.

His early existence was arduous. Born on a farm near Fort Scott, Kansas, he began to learn how to milk cows at seven. When eleven, he started working in the fields. His father's health failed when he was twelve, so that he and his brother took entire charge of the farm operations. The butter produced enabled the family to make a living, but no more than that.

At seventeen his mother sent him to Lawrence, Kansas, to enter the University of Kansas. Once there, however, he found a high school education a necessary condition for entering. Though well read, McCollum was not even equipped to pass the formal examination for entering high school. Owing, however, to the kindliness of Professor Frank H. Olney he was allowed to enter the high school in Lawrence on a probationary basis. From this point on, things went along fairly smoothly, although he had to earn his living expenses all the way through high school, college, and graduate school, and his health was by no means robust.

Having obtained the B.A. and M.A. degrees at the University of Kansas, he set out in 1904 for New Haven in second-class coaches, and arrived there with eighty-two dollars and no other financial resources. He entered the Yale Graduate School, where he spent three years that were very profitable academically and also financially. He was able to leave Yale with all his expenses paid and with $1500 additional, obtained by tutoring.

DR. McCOLLUM is essentially a biochemist, and he has been ever since his connection with the University of Wisconsin. The layman usually thinks of him as a dietary expert; an authority on the

various aspects of nutrition. All these designations are correct, but they are really outgrowths of a desire to carry the results of a biochemist's fruitful researches to the American people, that they might benefit. Seldom in the history of science has any man been so successful in translating his research into public welfare.

For the past twenty-three years Dr. McCollum has devoted himself to fundamental researches on food and nutrition. In 1913 he showed the existence of vitamin A. In 1915 he formulated in chemical terms the first effective working hypothesis concerning what constitutes an adequate diet. This hypothesis served to stimulate an enormous amount of nutritional research because it provided a guide for preparing experimental diets of many kinds and for the solution of specific problems.

On the basis of this working hypothesis he introduced a method for the biological assay of a food stuff. This consisted in feeding any food under investigation supplemented with single and multiple additions of known food constituents such as inorganic elements, vitamins, protein units, etc. The keynote to successful nutrition is the proper combination of foods, so that what is lacking in one is provided by another. The biological assay mentioned above yields information on this subject.

In 1921 he announced the discovery of the antirachitic vitamin known as vitamin D and showed its presence in cod liver oil. In the same year he described a type of diet which produces experimental rickets in animals. After these achievements very rapid advances were made in the understanding and treatment of rickets and in unfolding the chemical nature of vitamin D.

More recently, in addition to continuing his studies of the vitamins, Dr. McCollum has been studying the functions of minute amounts of inorganic elements occurring in the body. The remarkable anomalies obtained in the behavior of rats on manganese and magnesium-free diets are fruits of this work and are so recent and familiar as not to need further mention.

Dr. McCollum has been professor of biochemistry in the School of Hygiene and Public Health at Johns Hopkins University since 1917.

NO one is more respected by his co-workers than McCollum, as was amply pointed at a recent dinner tendered him by a group of his industrial associates. His unselfish and kindly treatment of his students is proverbial. His continued solicitude all through their professional lives is deeply appreciated by a host of them. He heartens them

when downcast, tells them rare stories from a rich fund of experience when all is well, and rejoices in their triumphs.

In the world beyond the portals of his laboratory he takes a most vigorous and constructive part. Recently he was a delegate to the International Dairy Congress in Copenhagen by appointment of the Secretary of Agriculture.

At the invitation of President Hoover he attended the White House conference on child welfare not long ago and made constructive contributions to this cause. For many years he has been connected with foundations for the promotion of mother and child welfare. He has been a contributor to the notable bulletins issued by the U. S. Labor Department concerning motherhood and infant welfare.

Not long ago he served on a committee to study the unsanitary bulk retailing of milk still prevailing in certain parts of New York City.

He is the author of an outstanding book on nutrition and has been a prolific contributor to scientific journals and magazines. Feeling that his researches on nutrition have important implications for the public health, he has not hesitated to develop these with force and clarity. He has been very successful in teaching the American public the value of milk, eggs, and leafy vegetables. He has designated these the "protective foods," a phrase which has come into universal use.

Thoroughly democratic, he treats his fellow scientist and his laboratory boy alike with courtesy, friendliness, and real concern for their welfare. Free from all trace of racial prejudice, he enjoys the warm regard of a most cosmopolitan group of people.

His mind is always open to new ideas. No doubt his liberality and tolerance have been strong factors in making possible his achievements in the world at large. A stream of people seems constantly to pour in upon him from the four corners of the earth for advice and for support of pet projects of bewildering variety. All of them receive a sympathetic hearing; and a worthy cause, whether in science or human welfare, always receives all the support and encouragement that can be wrested from a life already filled with unceasing work.

The Chemist—1932

By Withrow Morse

An industrial chemist reviews the prospects for the profession in the coming year and points out some of the opportunities.

WHAT may the chemist expect of the New Year? The logical procedure is to try to judge the unknown from the known.

We hear much of depression, whether we call it by that name or by Mr. Eddie Cantor's expression, "our smallest boom." Looking back we find that in other depressions recovery ensued in about two years or less:

1857	1 year	1903	2.1 years
1869	0.7 year	1907	0.5 year
1873	2.1 years	1914	0.7 year
1887	0.8 year	1921	1.2 year
1893	2.1 years	1929 to present	2.0 years (extrapolated)

Signs of returning progress are appearing. How much the chemist has suffered from the 1929 depression is hard to determine. One thing is evident: industry has utilized this means of unloading inert material. Many chemists of inferior capabilities have been asked to join the unemployed. Other industries have suffered similarly; and some, such as structural steel, have cut salaries in half. Chemists are not alone in their misery.

What is the cause of the failure of these chemists? Aside from special cases, we may say, with Dr. Donald Power, that the following factors determine the degree of success in the chemical field.

(1) Common sense.
(2) Ability to correlate work with that of others.
(3) Powers of observation.

Perhaps we might add imagination, a factor recommended by the president of one of our most successful corporations. Nothing is said of education, for that goes without saying; other things must be added to make success complete. And while we are discussing education, we may assert without much danger of being in error, that greater success would be gained by graduates if their training and interests had been broader. The universities produce analytical chemists and organic chemists and bio-chemists, all of whom take up their work in air-tight compartments. Any who transgress the bounds are brought abruptly to their senses. Yet many problems owe their solutions to a discoverer's ability to think in terms other than of his especial field.

A View of the Field

A glance at some of the larger divisions of industry of interest to chemists may be of value. One of the oldest is leather. Fashions come and gold standards go, but shoes go on forever. In September, 1931, $3.1 \times (10)^7$ pairs were made in the United States. England's quota is less, but new industries are developing in Russia, the Balkans, and elsewhere. I doubt that any industry as a whole has been less hard hit than the tanner's during the depression. Besides shoes, many other uses for leather exist—traveling goods, belting for machinery, etc. The chemists employed in this huge production are largely concerned with works control and analysis of tanning materials. There are visionaries among the more successful executives in the industry, however, and the splendid Cincinnati laboratory supported by the Tanner's Society is one expression. Much research, however, is needed. Improvements, especially in the pre-tanning stages, the so-called "beamhouse," could be made.

The textiles occupy perhaps the second place in the industries where chemists could participate to the advantage of the industry. Quoting Dr. Powers: "I venture to suggest that there is hardly a textile plant that knows what textile research is." The field presents a multitude of problems. The improvement in a single dye-process may mean thousands of dollars saved. We think at once of rayon when we think of the advance of textiles, yet there are other problems equally important to solve. For example, the printing of fabrics is largely a negative one: you print and then take out what you don't want. A positive, one-process method is desired. Dyeing on unweighted materials is another. Germany gives us most of the supplies for some of the textile work, as for example, the new sulphonated alcohols for use as soaps.

An editorial in the New York *Times* recently pointed out the trouble

with mining. The captains of coal industries have not progressed a step in the last twenty-five years. No advance has been made by industries outside the mining field. Coal, as a means of furnishing light and heat is a drug on the market, but coal when gasified is quite a different thing. Carbon monoxide, hydrogen, and other substances are obtainable from coal and can be made into methyl alcohol and valuable ketones. Further use of lubricants and fuels in the automobile scarcely can be expected; for the saturation point for motor cars must be nearly reached. Rather, coal can be gasified and utilized for home heating. This can be done at the mines, thus saving the long hauls of the solid.

Sulphur is lost to our soils and must be added. A form of sulphur, known as "flotation sulphur" is becoming available. It is very finely divided and highly reactive. It can be made into thiocyanates, fungicides that are non-toxic to the human being, textile weighting agents, and into photographic reagents. The research chemist can find other important uses for this form of sulphur.

No greater need exists, even granting the proverbial five-cent cigar, than improved containers for foodstuffs. I do not know how much damage is done by swallowing chips of glass or enamel, but I do know that our present practice of shipping and dispensing perishables in perishable containers is bad. My appreciation of the American chemist is too great to believe he could not invent something better. The chief desiderata are moisture-proofness and resistance to oil.

A General Plan for Chemists

These are but a few of the means by which the chemist can bring greater dividends to the manufacturer. Perhaps the chemist should follow the Swope plan and form some sort of a consolidation, not in restraint of trade, but for the purpose of education—practical demonstration of what he can do. Capital would be needed to begin with, but with laboratories working toward this end, revenue would begin to appear when it became evident that positive benefit to industry is possible. If the manufacturers themselves will not support research, let the chemist do it himself. But in so doing, let him not forget pure science, for from it will arise better yield in the long run.

In summary, then, we say: there are great opportunities for chemists, but they must make them practicable themselves and not await the slow-motion of the industries. The depression then will be largely what the chemist makes it.

BY-PRODUCTS

Literary Hoop Skirts

"THE practice of over-dressing ideas should be repressed," began the Barrister one morning recently. Have you met the Barrister? Well, he is first of all a scholarly gentleman and, secondly, he practices law in a philosophical manner, which means that he gets more fun than fees out of it and is happier. We generally disagree with him, so this morning when his idea seemed valid we ambushed ourselves behind a non-committal silence and awaited developments.

"It is only the occasional article," he continued, "that contains more than one new idea or point of view. And I am well aware that the larger portion is quite innocent of any novelty—like modern humor. Many books, even, are written around one idea and only one."

We suggested that one new idea at a time usually taxes the ordinary intellect to capacity.

"Precisely!" he exclaimed, tricking us into an apparent agreement. "Precisely. My argument is that one has to wade through so much literary excelsior before arriving at the central idea that there is a great waste of time, not to mention type, paper, and composition.

"Consider the case a moment. Suppose someone has a new idea or a new way of looking at a situation and wishes to publish it. Does he pen a few words of introduction, state the idea, expound it briefly, and then stop talking?"

"I'll bite," we said. "Does he?"

"No, he does not! He starts back somewhere in the prehistoric mists, gathers speed and slips into high with an array of magniloquent generalities, the truth of which was accepted generations ago, and by the time the reader is mentally groggy he gets to his point, states it, restates it, labors it, and finally coasts through a thousand words of literary cadenza looking for a good terminus."

We timorously suggested that a new idea cannot be thrust nakedly upon a hostile world but requires introductory and expository swaddling clothes to prepare the intellect for the novelty and to impress it on the mind; and we appealed to the incontrovertible biological fact that every nut is accorded its shell.

"Of course," he replied, tolerantly, "one needs some notice to allow

time for mental house-ordering before entertaining strange guests, particularly when they may not harmonize with guests of longer standing. However, how many filberts would be eaten if that nut had a husk like a cocoanut? So with these articles, the value of the kernel is too often out of all proportion to the labor of discovering it. Judicious literary adornment embellishes an idea as a fine setting enhances the beauty of a gem, but both demand a master hand, and too much of either will cause disaster to the intended effect."

This seemed unanswerable, so we merely said, "When you have thought more deeply on this subject you will begin to talk about unity."

What he said is immaterial, being personal, but it was appropriate.

Erudition and Truth

ONE of the underlying factors of the scientific Renaissance which we do not remember to have seen developed in just this way was the changed attitude among scholars, and consequently among all men, with respect to the attainment of truth. The reason that the ancient sages, Aristotle, Plato, Galen, Ptolemy, Plotinus, Augustine, and their contemporaries occupied so high a position in the estimation of medieval thinkers was partly due to the idea that those men knew truth by some mystical method, and the way to get truth was to resurrect it from the lore of past ages.

The collapse of this doctrine and the conviction that truth was still to be discovered, was in the future rather than in the past, were necessary mental conditions before the general adoption of the modern experimental method could be justified.

Since then mankind has set its face resolutely toward the future. The past has been left to leisure. Whence erudition has come to be regarded as a tool for intellectual advancement rather than as the accomplishment of an end in itself. Which is one of the reasons why scholars are inopulent.

Cellular Dilemma

THE process of karyokinesis completed, the two new cells regarded each other with interest.

"How do you do, daughter?" asked the first, politely.

"Where do you get that daughter stuff?" the second demanded haughtily. "Like all of the younger generation you lack respect for your elders! I'll teach you to be flippant toward your mother."

"Mother? That's rich," chortled the first. "Why, thirty seconds ago you weren't even thought of!"

"Silence, chit," roared the second. "If you could remember so far back you would know that thirty seconds ago I was just commencing the spireme out of which you came."

"You cannot know anything of spiremes," contradicted the first. "You have never yet experienced one. Laugh that off!"

"Oh, yeah? Well, if you are so wise, tell me where you were when I was a spore."

"Spore? Where did *you* learn that word? I was the spore, you were non-existent."

"Imbecile! I sporulated in order to survive that tremendously hot spell we had a few hours ago. If I hadn't been quick-witted you wouldn't be here."

"It's impossible that you should remember that hot spell. You simply weren't there!"

"Oh, yes, I was. That was just after I had taken up residence in that delectable cat's intestine. But you wouldn't know anything of that."

"I remember it perfectly," the first declared. "I had located in a mouse, but that was an error of judgment because the mouse specialized on a high carbohydrate diet and I prefer more protein in mine."

"Your imagination is marvelous! It was I in the mouse, and there your elder sisters were born. They, I grieve to say, were just as disrespectful as you are."

"Those were *my* daughters, ungrateful child! I remember I had to kill several of the mouse's cells to get enough cystine to feed them."

"Where you acquired a knowledge of sulphur metabolism is a mystery to me," sighed the second helplessly. "The only solution is that you have inherited my memory."

"No, you got yours from me. Why, I can remember when I was purely saprophytic and thought cellulose most delectable."

"And I can remember the time long ago before we had to worry about hydrogen-ion concentration. Those were the happy days," she sighed.

"Pshaw, I can remember the days when they used to call me an animalcula."

"Moonshine! You'll be claiming to recall the great flood next. Perhaps you sailed on the Ark?"

"Oh, yes. I was symbiosing with a dodo then. That was recent."

"Brag on." There was an evil glint in the second's nucleolus. "I once inhabited a flea on Pithecanthropus!"

The first started to reply but seemed to be taken with a spasm. "Ouch," she cried, "I feel queer. I'm sick!"

"Nothing to worry about," the other said reassuringly, "you are just going into your prophase. Your centrosomes are separating, your nuclear wall is dissolving, the sperm forms! There are the chromosomes. Metaphase! Anaphase! Telephase! Behold, I have two grand-daughters."

"The heck you say," snarled the first-half. "I'm still here. Meet my daughter."

"Where do you get that daughter stuff?" demanded the second-half. "You are my daughter, half-sister to this party," flipping a cilium toward the undivided cell.

"Why, I'm your grandmother, my dear," cooed the second. "Welcome to the family and may you always find a fertile environment to vegetate in."

"I like that," the second-half complained. "You telling me! Why I am very old. I can remember when I inhabited a flea on Pithecanthropus!"

"Look out!" yelled the first-half, "here comes a chemotactic leucocyte. Scram!"

The three disputants set off at top speed, something like a centimeter per hour, but the patrolling cells were too speedy for them and after two hours and twenty-one minutes caught and engulfed the arguers and argument. And it was never settled.

Carbonium Gnitrate says that a materialist is like a man with a marvelous perpetual motion machine that he cannot get started. Pretty slick feller, that Carbonium.

—*The Autocratic Chemist*

The Research Attitude

By Howard W. Post

A discussion of the ends of collegiate education. The acquiring of a proper mental viewpoint as the chief product of a chemical training.

THERE is perhaps no single point on which chemists differ so radically as on that of the building up of the ideal undergraduate curriculum for our colleges. Whether the major differences found on a glance at the catalogues of our leading educational institutions come from a really sincere conviction that things should be thus and so, or whether they arise from a fancied necessity for adaptation to circumstances is always a matter for debate; but nevertheless the fact remains that there is no uniformity, on the surface at least, between the various undergraduate programs which lead the student to the bachelor's degree, majoring in chemistry.

Yet there should be and undoubtedly is, beneath the surface, a condition of conformity which is becoming more and more general—conformity to the extent of teaching the student to educate himself rather than to be educated.

Many instructors have come to realize that a class of poor students can often make better "progress" than one of higher quality. A group of students who are not interested in the subject matter of a course, who never ask questions, and who follow the instructor, generally, it must be admitted, about five minutes behind him, will permit the course to proceed without any interruptions whatever. No questions will disturb the steady flow of information, and no time will be consumed answering doubts and queries. On the other hand, a class which is on its toes and thoroughly interested can think up more sincere questions

in one hour than the instructor can answer; but however he may dread this possibility, he is pleased by the show of interest. It is a source of satisfaction that he has stimulated interest and that his charges are thinking beyond the mere facts he is giving them.

Attitude the Important Factor

The difference between these two groups is primarily one of attitude. The disinterested group has what might be called the "absorptive" or even the "adsorptive" attitude toward its work while the others could be classed as having developed, probably unconsciously, the true research attitude.

By research attitude is not meant the development of the ability to do independent research in the laboratory or even independent investigation in the library. By research attitude is meant that bent of mind which naturally suggests questions. Some of us were told in our earlier days to cultivate the habit of habitually thinking beyond the page we were reading and of asking ourselves how the reaction would work if such and such a change were made in the compound under consideration or in the conditions of the experiment.

Fundamentally the development of the research attitude should be, and in the larger institutions of learning is, the underlying principle back of the undergraduate curriculum. Students are encouraged to think for themselves, to pursue ideas and topics off the beaten paths of their courses and to discuss their ideas and formulate their opinions independently of any faculty help. In fact, it might be said that without this tendency on the part of the undergraduate colleges of this country it will be difficult if not almost impossible to raise up a generation of chemists who will carry on the spirit and the fact of research after they have completed their more formal education. Of course the graduate schools do make use of this concept, but students not introduced to this type of thinking during their undergraduate days do not ordinarily find their way to any graduate school, at least not in as large numbers as do those from institutions where they have been taught to do a little mental prospecting on their own resources.

Method of Teaching

The research attitude can be taught through the medium of courses, but not necessarily so. Irrespective of what may be the individual ideas of many educators of today in the field of chemistry, a thorough training in the four major fields—inorganic, organic, analytical, and

physical—is necessary. But these four fundamental courses if taught properly can be presented with an inspirational slant that makes all the difference in the world. One instructor in the memory of the writer always presented the material of his beginning course as if he had just heard of it the day before—it was so new and startling that he apparently just had to spread the good news around wholesale. Naturally, this lifted his lectures out of the humdrum monotony which always characterizes the imparting of collections of facts. His students learned almost in spite of themselves.

Instead of discussing courses and attempting to define the importance of one course as compared or contrasted with another, let's get down to fundamentals and develop the research attitude in our undergraduates.

BOOK REVIEWS

Patent Law—For Chemists, Engineers, and Executives. By FRED H. RHODES. *McGraw-Hill.* $2.50.

The Psychology of the Inventor. By JOSEPH ROSSMAN. *The Inventors Publishing Company.* $2.50.

It has become the veriest of platitudes to call this the age of specialization. Yet the mere existence of the books named above serves to emphasize again how narrow are the limits and how great the number of our specialties. Both Professor Rhodes and Dr. Rossman have cast their nets into the broad sea of invention, and each has caught an edible fish.

Professor Rhodes' book is a particularly useful contribution. It has the tone of a textbook for senior students of chemistry and engineering. It is illustrated from their point of view, and its subject matter has been selected for their more probable needs. This even goes to the length of including some advice on patent procedure which is rather a personal viewpoint than based on any actual law. However, despite this material, the balance of the book should be thoroughly familiar to all of its addressees and is well designed for their assimilation.

Dr. Rossman has chosen a less trodden path than Professor Rhodes. He has tried to dissect and study the mental processes of the inventor both in general makeup and while invention is in *statu nascendi*.

To do this Dr. Rossman has drawn partly on his personal knowledge through contact with many inventors; partly on answers to questionnaires; and partly on quotations from published statements by inventors.

The net result is not easy to appraise on the basis of the varied data submitted. Still, it is possible to see that to some extent there is a special inventor's psychology. Beyond this, the cited variations add value to the book for all those who must deal with inventors. It is doubtful whether taking thought will enable one to become an inventor, any more than it will affect one's stature. For one who has business relations with inventors, however, this book will serve to increase his knowledge of and respect for the tribe.

KARL M. HERSTEIN

Chemical Analysis of Iron and Steel. By G. E. F. LUNDELL, JAMES IRVIN HOFFMAN, AND H. A. BRIGHT. *John Wiley & Sons.* $7.00.

Probably no branch of chemistry has attracted as much public attention and undergone as great development in the last few years as ferrous alloys. Stainless steel has been a great boon to the public; but it has at the same time greatly increased the difficulties of technologists. In particular, the new alloys, of complicated formulas, have put a strain upon the analytical chemist, already sorely tried in the steel industry by the short time allowed him for his determinations. And some of these analyses must be done with almost atomic weight accuracy.

The Bureau of Standards chemists who are the authors of *Chemical Analysis of Iron and Steel* have tried to bring the entire subject up to date. They have included methods applicable to varying requirements. Realizing that new alloys will probably bring new problems, they have also tried to lay down some general principles which will guide analysts confronted with still newer alloys.

This very comprehensive work is intended chiefly for works chemists, whether those just beginning their career or those who have had considerable experience in the ferrous analysis field.

The book is well constructed, as is essential for a work intended for use as a laboratory manual. We are still waiting, however, for a book which will have its pages coated with a drying oil resistant to the chemicals which usually obliterate valuable portions after a short period of practical use.

C. K.

OUR AUTHORS

Kodak Chemist

Walter Clark, Ph.D. (London), began his chemical career with the British Photographic Research Association. In 1928 he became superintendent in charge of research for Kodak, Ltd., the English branch of the Eastman Kodak Company. Last year he was transferred to the Kodak Park Works.

Creation of Wealth

F. H. Bivins (Cornell, '27), is one of the intelligent young men the up and coming consulting organization of Foster D. Snell, Inc., sends around to run the plants of clients. In this capacity Mr. Bivins has been the plant manager of the Puritan Soap Company at Rochester and the Stonite Company in Brooklyn. Vice-president of Foster D. Snell, Inc., since 1930, he is now in the home office.

"Ethics and Advertising"

Karl M. Herstein, F.A.I.C., has had wide industrial experience in such varied fields as tobacco, textiles, foods, inks. Much of his professional career has been in general consulting work. Since 1923 he has been with the Hochstadter Laboratories. Equipped with a logical mind, Mr. Herstein is known as a chemical expert who carries his clear thinking to the witness stand. Interested in Institute affairs, he is the New York representative to the National Council.

Mr. Herstein's hobbies are bridge and working in pewter. His favorite author is James Branch Cabell.

Education of the Textile Chemist

Albert H. Grimshaw, F.A.I.C., is a New Englander who began his business career as a pharmacist, at which profession he spent fifteen years. Then he went to the New Bedford Textile School and to North

Carolina State College. After graduation he returned to New Bedford to teach textile chemistry, now is back in North Carolina as associate professor of chemistry and dyeing.

His particular technical interest is textile starches and sulphonated oils. He writes for the *Textile World, Photographic Manual, Cotton, Textile Colorist.*

Short, stout, good-natured, Mr. Grimshaw is an enthusiastic golfer, also spends much of his spare time at his hobby of photo-micrography. Interested in his students, he is a popular teacher.

Technical Writer

Edward Thomas, Haverford '97, is a patent lawyer whose hobby is writing. Applying the technique of short story writing to his scientific work, he has contributed articles to *Industrial and Engineering Chemistry, Popular Science, Science and Invention, Chemical and Metallurgical Engineering.* He is the author of a book on economics and of *The Law of Chemical Patents,* the standard work on the subject.

In his patent work Mr. Thomas finds valuable his seven years' experience in the wholesale chemical business. He is a member of Phi Beta Kappa and of various technical and legal organizations.

The Chemist and Bacteriology

M. Starr Nichols, F.A.I.C. (Ph.D. Wisconsin), first studied pharmacy, which he practiced for six years before he decided to go to the University of Wisconsin and become a chemist. He has been at Wisconsin ever since, first as a student and then as a member of the faculty. He spends part of his time as chief chemist of the Water and Sewage Laboratory of the state department of hygiene.

A member of many scientific and medical organizations, Dr. Nichols has published treatises in a number of publications. Colleagues know him as a hard worker who knows his field well. In spite of the constant press of routine work in his laboratory, he finds time for research, and generally has in mind some problem to which he devotes his spare minutes.

"The Research Attitude"

Howard W. Post, F.A.I.C., Ph.D. (Hopkins), has specialized in teaching organic chemistry at Syracuse and Princeton, and is now

at the University of Buffalo, where his chief educational interest has been the developing of new methods of teaching. His chemical interests are the ethylene compounds and aliphatic ortho esters, on both of which he has published papers, and has others now in preparation.

McCollum Biographer

S. M. Weisberg, F.A.I.C., Ph.D. (Hopkins), appeared before in our pages as the author of "The Chemist in Public Health." Dr. Weisberg is thoroughly wrapped up in chemistry, and makes that science a hobby as well as a profession. Occasionally he takes time for sports, but he would much rather spend an evening with one or two friends sitting before a fire and discussing chemical problems.

An energetic contributing editor, Dr. Weisberg spotted and procured for *The* CHEMIST Dr. Harden Taylor's article, "When You Decide to Go in for Research," which appeared last month.

The Chemist—1932

Withrow Morse, Ph.D., spent much of his career in teaching, and now is with Rohm & Haas Company, working on protein chemistry and the enzymes. He is also making an extensive study of the skin.

Dr. Morse is the author of *Applied Biochemistry,* and of articles in *Industrial and Engineering Chemistry.* He spends his spare time climbing mountains and making photographs. Jazz, Atlantic City, and colloidal chemistry, all annoy him.

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HORACE G. BYERS	NEIL E. GORDON	HENRY ARNSTEIN	L. V. REDMAN
M. L. CROSSLEY	ARTHUR E. HILL	HENRY G. KNIGHT	ALLEN ROGERS
TREAT B. JOHNSON	A. P. SACHS	HERBERT R. MOODY	FREDERICK W. ZONS

Philadelphia Representative EUGENE F. CAYO

New York Representative KARL M. HERSTEIN

Washington Representative DANIEL F. J. LYNCH

National Council Notes

The eighty-sixth meeting of the Council of The American Institute of Chemists was held at The Chemists' Club, New York, N. Y., on Thursday, December 14, 1931, with President Frederick E. Breithut presiding.

The following councilors and officers were present:

Messrs. Arnstein, Cayo, Crossley, Gordon, Harold, Herstein, Hill, Knight, Neiman, Rogers, Zons. Mr. E. L. Gordy, editor of *The* CHEMIST, was also present.

The question of the medal award was discussed at length.

On motion made and seconded, the following amendments were made to the By-laws:

The title to Article IV was amended to read:

"The Medal of The American Institute of Chemists."

Article IV, Section 1, was amended to read:

"A gold medal may be presented by The American Institute of Chemists under the conditions hereinafter set out. This medal shall be known as the medal of The American Institute of Chemists. The date of the founding of the medal shall be 1925, and the founding shall be for the purpose of stimulating activities of service to the science of chemistry or the profession of chemist."

Article IV, Section 2, was amended by changing the words "The American Institute of Chemists' Medal" in lines one and two thereof to "the Medal of The American Institute of Chemists."

Article IV, Section 4, was cancelled.

Article IV, Section 5, was changed to Section 4 to read:

"The Jury of Medal Award will meet upon call of the chairman."

Article IV, Section 6, was changed to Section 5, to read:

"The Jury of Medal Award of The American Institute of Chemists shall have power to decide any question or questions not specifically covered by these rules."

Article XIII, the first sentence was titled "Section 1;" the second sentence was titled "Section 2," to read:

"*The* CHEMIST shall be issued monthly." The third sentence was titled "Section 3."

Mr. Herstein reported that the committee on constitutional revision had been operating. The committee was requested to report at the next meeting of the Council.

The secretary presented the report of the committee on ethics. Section 13 was revised by inserting the words "as substitute" after the word "employer" in the second line thereof.

The following sub-section "e" was added to Section 18: "He shall not suppress information or accentuate statements in reports for the purpose of making gain or profit for himself or others."

After further discussion the report was referred back to the committee.

Mr. Herstein submitted a suggested form of pamphlet relative to the Institute. It was adopted, and the editor was authorized to print 1000 copies.

The secretary read a letter from A. C. McClurg and Company relative to the history of American chemistry, and he was instructed to advise this company to communicate with Dr. Harrison E. Howe, editor of *Industrial and Engineering Chemistry*.

The treasurer's report was read and ordered filed.

The CHEMIST was discussed in detail and it was decided that the present size be retained for next year, and that dull paper be used.

HOWARD S. NEIMAN, *Secretary*

Pennsylvania Chapter

The Chapter met on Tuesday, January 5th, at the Engineers' Club, with Franklin D. Jones presiding. After reading the minutes of the previous meeting, Mr. Cayo reported on the 85th and 86th meetings of the National Council.

The meeting was addressed by Mr. Jesse Laventhol, staff correspondent of the *Philadelphia Record*, whose subject was "What is Technical News?"

Mr. Laventhol gave a very lucid description of the makeup of a metropolitan newspaper and the method of gathering news.

Scientific news is conveyed to the papers by Science Service and similar agencies to which each paper subscribes. Special reporters are sent to cover important scientific meetings. These reporters are often men with scientific education.

The metropolitan daily consists of a local or city department which covers news of the city and suburbs, and the telegraph department, which handles news from the various news services. There are also the specialized departments such as financial, sporting, feature —each in charge of a specialist. Syndicate news is purchased by the city editor or by the feature editor.

The city editor acts as general supervisor and handles the most important news. The assistant editor reads and corrects the copy. The copy-readers write the head-lines.

Reporters under the city editor are assigned to routine beats, such as the City Hall, Federal Building, etc. Police reporters have contacts at police headquarters. Political reporters cover the legislature and political meetings. Shipping reporters cover immigration, office of Collector of the Port, Maritime Exchange, and allied organizations.

There is what is called the court combination which is paid by all the newspapers for covering all routine news. Special reporters are sent only on important cases.

Private tips from disgruntled people sometimes lead to important news. Special investigators are assigned to important cases.

The telegraph department is usually in charge of a man who has considerable international experience.

* * * *

Mr. Laventhol was given a rising vote of thanks. The meeting was well attended and aroused considerable discussion.

The February meeting will take place at the Engineers' Club on February 2nd, and will be addressed by Dr. William Seifritz, Professor of Botany, University of Pennsylvania, who will speak on "The Status of the Scientist in Russia." The lecture will be prefaced by a few remarks by Solomon Feinstone, F.A.I.C., on the political background of the Russian experiment.

BENJAMIN LEVITT, *Secretary*

Washington Chapter

A meeting of the Chapter was held December 11th in Baltimore.

Two inspection trips were offered to members and friends. About twenty people availed themselves of the opportunity to inspect McCormick and Company or the Davidson Chemical Company.

The group going to McCormick and Company were met by Mr. Karl, head of employment, and by Dr. John Glassford, chief chemist. They were then taken through the plant and shown the inside workings of spice, tea, insect powder, spray manufacture. The McCormick Company makes more than 200 products, so that there was something of interest to everyone. Quite a long time was spent in the chemical laboratory.

This group also visited the laboratory of the National Dairy Products Company.

The second group went to Davidson Chemical Company. They were shown through the sulphuric acid and copper-recovery plants by Mr. McCready and Mr. Taylor. Mr. Thomas showed them through the superphosphate plant.

There was a dinner meeting afterward at Weber's restaurant. Four of the Baltimore members of the Washington Chapter attended. Dr. Samuel Weisberg was elected vice-chairman to take the place of Dr. Markwood, who has changed his membership to the New York Chapter. Dr. E. Emmett Reid, head of the department of chemistry at Johns Hopkins University, spoke a few words on "Why I Am a Member of the Institute."

J. DAVID REID, *Reporter*

New York Chapter

A joint meeting of the New York Chapter of the Institute with the American Chemical Society, the Society of Chemical Industry, the American Electrochemical Society, and the Société de Chimie Industrielle, was held at The Chemists' Club, Friday, December 11th, with Chairman Frederick Kenney presiding. About two hundred members of the various societies attended. The address of the evening was delivered by Mr. Edward Thomas, Patent Attorney, who spoke on "Business Meets the Chemist." Mr. Thomas' talk is reported in full elsewhere in this issue of *The* CHEMIST.

Mr. Thomas' paper aroused considerable discussion. Among those who commented were: J. F. X. Harold, H. O. Chute, M. L. Crossley, W. J. Baëza, Leon V. Quigley, P. J. Wood.

New Members

The following members were elected at a meeting of the National Council held December 10th:

FELLOWS

HARRY BELL MCCLURE, Technical Division, Carbide and Carbon Chemical Corporation, 30 East 42nd Street, New York, N. Y.

LEROY DAVENPORT SOFF, Chief Chemist, Paragon Paint and Varnish Corporation, Long Island City, N. Y.

JUNIOR

GALEN F. HOFFMAN, Student, Juniata College, Huntingdon, Pa.

Applications for Membership

FELLOWS

CHARLES BARBAN, Consulting Chemist and Chemical Engineer, 1133 Broadway, New York, N. Y.

JOHANNES SYBRANDT BUCK, Senior Organic Chemist, Burroughs Wellcome and Co., Tuckahoe, N. Y.

EPHRAIM FREEDMAN, Director, Bureau of Standards, R. H. Macy & Co., Inc., 34th St. & Broadway, New York, N. Y.

CHARLES W. RIVISE, Patent Attorney, 1321 Arch Street, Philadelphia, Pa.

JUNIORS

EVA RUTH HARTZLER, Student, Juniata College, Huntingdon, Pa.

NEWS

Townes R. Leigh, Head of the Department of Chemistry at the University of Florida, has been elected President of the American Association of Colleges of Pharmacy.

In 1923 Dr. Leigh was instrumental in establishing the College of Pharmacy at Florida, and has been Dean of the institution from its beginning.

A. Richard Bliss, Jr., F.A.I.C., has been elected president of the Tennessee Academy of Science.

Honor Noted Chemist

A committee of members of the Cosmos Club, Washington, D. C., have presented to the club a portrait of the capital's distinguished chemist, Charles E. Munroe, F.A.I.C. The presentation was made by Henry G. Knight, F.A.I.C. The presentation took place before a large gathering of friends and associates in the assembly hall of the Club.

The portrait was arranged for by a committee consisting of A. C. Fieldner of the Bureau of Mines, R. A. Gibson, President of the Washington Chemical Society, D. F. J. Lynch, Chairman of the Washington Chapter of the American Institute of Chemists, former Chief Justice Walter I. McCoy of the District Supreme Court, Cloyd Heck Marvin, President of George Washington University, Dr. Knight, and H. S. Washington.

James F. Couch, F.A.I.C., of the Bureau of Animal Industry, originated the plan for honoring Dr. Munroe in this manner and took a leading part in bringing the plan to a culmination.

Among others who attended the ceremony were about fifty non-members of the Cosmos Club.

Herbert R. Moody, F.A.I.C., professor of chemistry at the College of the City of New York, reports that Soviet officials recently refused to allow a copy of Mendeléeff's periodic chart of the elements to pass through the mails, fearing that the strange document might be an enemy code.

A. C. S. Head for 1933

Arthur Beckett Lamb of Harvard University, has been elected President of the American Chemical Society for 1933.

Professor Lamb, a Tufts graduate, is probably most famous as editor of the *Journal of the American Chemical Society,* a position he has held since 1917. He is also director of the chemical laboratories of Harvard University and delivers lectures in elementary inorganic chemistry. Doctor Lamb is a member of The Chemists' Club, where he is frequently seen on visits to New York in connection with his consulting practice.

The American Drug Manufacturers' Association will hold their next annual convention at the Greenbriar Hotel, White Sulphur Springs, West Virginia April 18 to 21, 1932.

Florence E. Wall, F.A.I.C., delivered a talk on "The Greatest of Modern Arts," a discussion of beauty culture and cosmetics, to the students at St. Elizabeth's College, Morristown, New Jersey.

H. T. Herrick, head of the Color and Farm Waste Division of the Bureau of Chemistry and Soils, spoke on the subject of "Recent Developments in the Industrial Synthesis of Organic Products by Fermentation" at the meeting of the Montreal Section of the Society of Chemical Industry. From January 18th to 21st, inclusive, he will speak on this subject before the Syracuse section, the University of Michigan section, the Detroit section, and the Toledo section of the American Chemical Society.

Edward Zenck, a member of the Executive Committee of the Drug, Chemical, and Allied Trades Section of the New York Board of Trade was the guest at a farewell dinner of the committee on December 8th at the Waldorf-Astoria.

Mr. Zenck is going to Indianapolis as sales manager for Ely Lilly and Company.

New Tariff

The British Board of Trade announces a list of chemicals upon which a 50% *ad valorem* increase in tariff applies, beginning December 26th.

Included are the following: citric acid, tartaric acid, cream of tartar, aluminium sulphate, ammonia alum, soda alum, potash alum, and lithopone.

Warner D. Huntington, vice-president of Davison Chemical Company of Baltimore, has resigned to become Director of Sales for the American Cyanamid Company.

C. H. Desch of the University of Birmingham, England, lectured before the Chemical Club of Princeton on December 11th. His subject was "Mosaic Structure in Crystals." Dr. Desch is now serving as Baker Lecturer at Cornell University.

Hugh S. Taylor of Princeton University, is in Europe on sabbatical leave. He delivered a course of lectures at

HUGH S. TAYLOR

Manchester University on kinetics, catalysis, and photochemistry.

The Faraday Society is planning a symposium on the adsorption of gases, which is to be held at Oxford University, beginning January 12th, and Dr. Taylor is to give the opening lecture.

A. Von Grosse has been appointed research associate in inorganic chemistry at the University of Chicago, as a result of a gift from the Universal Oil Products Company. Dr. Von Grosse, the discoverer of proactinium, element 91, will continue research work in the field of the rare elements.

A New Industrial Service

A new type of service organization, to facilitate the marketing of industrial products, has been formed by H. H. Sheldon, H. A. Morse, L. W. Hutchins, and W. H. Easton, all well known in

L. W. HUTCHINS

many branches of industry, engineering, and science. The company, with offices at 191 West 10th Street, New York City, will be known as Sheldon, Morse, Hutchins & Easton.

This group will give special attention to the economic problems arising in connection with scientific research by assisting manufacturers to determine the applications and markets for products in the laboratory or development stages, estimate the amount of research expenditures that are economically justified, make surveys of competition and patents, and plan supplementary research work and the development of new products to meet market conditions.

The company also plans to furnish manufacturers with a complete sales research, advertising, and publicity service, based on the principals' experience in the promotion and sales of chemicals, electrical equipment, building materials, industrial and marine supplies and machinery, scientific apparatus, and other lines.

William Foster, F.A.I.C., and **E. R. Caley** of Princeton University, have charge of the chemical problems connected with the American excavations at Corinth and at the Agora in Athens. The field work is being directed by **T. L. Shear,** Professor of Classical Archaeology at Princeton.

Reversible Coagulation

H. Becket Lang, director of chemical psychiatry at Marcy State Hospital, has announced a new treatment for dementia praecox and other mental diseases as a result of the work of Wilder D. Bancroft on reversible coagulation of nerve colloids. Very encouraging results have been obtained by treating hospital patients with dispersing agents utilized according to theories enunciated by Professor Bancroft and other Cornell experimenters.

Research Training

In connection with the new chemical laboratory of the Chalmers Institute of Technology, Gothenburg, Sweden, a separate building will be erected for research work on an industrial scale.

Professor Hedvall believes that the educational training of students for research work has been too much neglected, such training being one of the most important features of college chemical education. Graduate and post-graduate research work in collaboration with directors contributes very much to the knowledge and capacity of the students for future independent work.—C. A. Robak in *Industrial and Engineering Chemistry.*

D. S. Villars of the Standard Oil Company of Indiana, delivered a lecture before the Chemical Society on the calculations of chemical constants from optical data.

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Bulletin No. 460 gives details of comparators for hydrogen ion work, and Bulletin No. 442 gives details of the comparators for water testing.

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